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Section 5 of 5

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INTEGRATED INFORMATION SUPPORT SYSTEM (IISS)
Volume V - Common Data Model Subsystem
Part 9 - Neutral Data Manipulation Language (NDML) Precompiler Development Specification
Section 5 of 5

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13. ABSTRACT

This development Specification (DS) describes the functions, performance, environment, interfaces, and design requirements for the Neutral Data Manipulation Language (NDML) Precompiler. The NDML Precompiler is a component of the Common Data Model Processor (CDMP) and it is used to generate various programs (e.g., request processor or RP, RP drivers, CS-ES transformers, and local subroutine callers) tailored to satisfy the NDML requests in a specific application program.

This report is divided into five (5) sections.

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SECTION 27

FUNCTION PRE10 - Build Calls and Messages

This function will control the processing logic for the generation of all code into the users application program to satisfy a NDML conceptual schema transaction.

This function:

1. Generates code into the procedure parcel of the application program which assembles information needed by the Distributed Request Supervisor into a message to satisfy an NDML request and sends that message to the Distributed Request Supervisor.

2. Generates code in the procedure parcel for receipt of results from the CS/ES Transformer and for presentation of the results to the user.

NOTE: If the user's application program is written in FORTRAN, then as of release 2.3, all FORTRAN variable names will be generated with a length of six. This will be done by generating names of the convention: CDMXXX where XXX is any combination of three characters. The three character combination is determined by routine CDCREFO. This routine associates a six character FORTRAN variable with the corresponding COBOL variable. This association between the COBOL name and the generated FORTRAN name is stored in the FORTRAN-VARIABLE-TABLE. The FORTRAN-VARIABLE-TABLE is copied into modified user's application program. In this design specification, the COBOL name will be used to show how the FORTRAN code will be generated.

27.1 Inputs

1. External Schema representation of the data

   ES-ACTION-LIST
   ES-QUALIFY-LIST

2. Conceptual schema representation of the data

   CS-ACTION-LIST
   CS-QUALIFY-LIST

3. Internal Schema representation of the data

   IS-ACTION-LIST
   IS-QUALIFY-LIST

4. Join Query Graph for the NDML request

   JQG
   JQG-ATTRIBUTE-PAIR-LIST

5. Result Field Table

   RFT

6. Subtransaction table for the NDML request

   SUBTRANS-PROCESS-ID-TABLE

7. Code generation table

   CODE-GENERATOR-TABLE

8. Application Program parcel names

   IDFILE-NAME
   FDFILE-NAME
   WORKFILE-NAME
   PROCFILE-NAME

9. Application Program error file name

   ERROR-FILE

10. Conceptual/External Schema transform program name

    CS-ES-MOD-NAME

11. Source Language of the Application Program

    SOURCE-LANGUAGE

12. User View Abbreviation List

    UV-ABBR-LIST

13. Input-Output Section Indicator

    IO-SECTION-INDICATOR

14. Block Stack

    BLOCK-STACK

15. Logical Unit Work Name

    LUW

16. First Inner Select Flag

    FIRST-INNER-SELECT

17. Fortran Variable Association Table

    FORTRAN-VARIABLE-TABLE

18. Target Host Name

    TARGET-HOST

27.2 CDM Requirements

None

27.3 Internal Requirements

A temporary conceptual schema action list to be used during processing of inner selects of a query combination command. RET-STATUS and QCS-CDMP-CHECK-STATUS

27.4 Processing

1. Initialize the program variables and files.

   1.1 Initialize return status of function to good status.

   1.2 Open the four parcels of the users application program.

   1.3 Determine the source language of the program and set local variable.

   ```
   If SOURCE-LANGUAGE = "COBOL"
     set LANG-IND to 1
   else
     set LANG-IND to -1
   ```

2. Determine if this is the start of a transaction and process the insert values, if it is also an Insert transaction.

   2.1 Generate working storage required for each new NDML statement that is not an End Curly, Exit, Break, Next or Continue. Call "CDMACR" utility with the following:

   ```
   Library Name - COBOL
   Macro Name - UAPESWS
   Parameters
     EE = ES-NDML-NO

   Library Name - VAXFORTRAN or IBMFORTRAN
   Macro Name - UAPESWS
   Parameters

   P1 = CDM-CS-RESULTS-FILE-ee
   P2 = CDM-INPUT-NAME-ee
   P3 = CDM-CS-RESULTS-ee
   P4 = FCB-CDM-RESULTS-ee
   P5 = FCB-INPUT-ee
   P6 = CDM-INPUT-RETURN-LENGTH-ee
   P7 = CDM-INPUT-RECORD-LENGTH-ee

   where ee = ES-NDML-NO
   ```

2.2 If it is not the case that ES-ACTION = "I" and ES-NDML-NO does not equal the previous ES-NDML-NO continue at step 2.7 otherwise continue at step 2.3.

2.3 Generate code for the start of the loop for an Insert command.

Determine if the Insert is from a user file, user structure or a list of user values.

2.3.1 If ES-FILE-NAME = SPACE and ES-STRUCTURE = SPACE continue processing at step 2.4.

2.3.2 If ES-FILE-NAME NOT = SPACE continue processing at step 2.5.

2.3.3 If ES-STRUCTURE NOT = SPACE continue processing at step 2.6.

2.4 Generate code for an insert from a list of user values.

2.4.1 Determine how many rows of values the program will insert by counting the used ES-LOCAL-VARIABLE or ES-VALUE variables in the ES-ACTION-LIST and store the results in local variable ES-VALUE-USED.

2.4.2 Generate the temporary table to hold the insert values. Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - UAPWSI
Parameters
  P1 = ES-VALUE-USED
  EE = ES-NDML-NO

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - UAPWSI
Parameters
  P1 = ES-VALUE-USED
  P2 = CDM-INPUT-INDEX-ee
  P3 = CDM-INPUT-USED-ee

where ee = ES-NDML-NO
```

2.4.3 Generate data definitions for insert values.
Call function "CDP1OE" with the following parameters.

```
LANG-NO
IDFILE-NAME
FDFILE-NAME
WORKFILE-NAME
PROCFILE-NAME
ES-ACTION-LIST
```

ES-VALUE-USED
FORTRAN-VARIABLE-TABLE
QCS-CDMP-CHECK-STATUS

2.4.4 Generate code for the start of the insert loop.
Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - INSVAL1
Parameters
  EE = ES-NDML-NO

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - INSVAL1
Parameters
P1 = CDM-INPUT-INDEX-ee
P2 = CDM-INPUT-USED-ee
EE = ES-NDML-NO

where ee = ES-NDML-NO
```

2.5 Generate the code for an insert from a user file.

2.5.1 Generate variable name into WS parcel if language is COBOL. Generate:

```
01  CDM-INPUT-ee.

where ee = ES-NDML-NO
```

2.5.2 Generate data definitions for insert values. Call function "CDP1OE" with the following parameters:

LANG-NO
IDFILE-NAME
FDFILE -NAME
WORKFILE-NAME
PROCFILE-NAME
ES-ACTION-LIST
ES-VALUE-USED
FORTRAN-VARIABLE-TABLE
QCS-CDMP-CHECK-STATUS

2.5.3 Generate code for beginning of loop of insert from a file. Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro name - INSFIL1
Parameters
 EE = ES-NDML-NO
 F1 = file name specified by the user.

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - INSFIL1
Parameters
  P1 = CDM-INPUT-NAME-ee
```

```
P2 = FCB-INPUT-ee
                    P3 = CDM-INPUT-RECORD-LENGTH-ee
                    P5 = CDM-INPUT-ee
                    P6 = CDM-INPUT-RETURN-LENGTH-ee
```

2.5.4 Move 1 to START-POS.

2.5.5 Generate code that will move the insert values from the input record to the insert variables generated in the program. For each non-deleted entry in the ES-ACTION-LIST, perform steps 2.5.5.1 through 2.5.5.5.

```
2.5.5.1  If ES-TYPE = "C" or "I"
         calculate END-POS = START-POS +
             ES-SIZE -1
         If ES-TYPE = "F"
         calculate END-POS = START-POS +
             ES-SIZE

2.5.5.2  If ES-TYPE = "C", generate:
         ES-VAR-INS-ee-ii =
         CDM-INPUT-ee(sp:ep)
         where ee = ES-NDML-NO
               ii = ES-INDEX
               sp = START-POS
               ep = END-POS

2.5.5.3  If ES-TYPE = "I", generate:
         CHAR-ES-VAR-INS-ee-ii =
         CDM-INPUT-ee(sp:ep)
         CALL
          CHRINT(CHAR-ES-VAR-INS-ee-ii,
          ES-VAR-INS-ee-ii, NDMLST)

         where ee = ES-NDML-NO
               ii = ES-INDEX
               sp = START-POS
               ep = END-POS

2.5.5.4  If ES-TYPE = "F", generate:
                CHAR-ES-VAR-INS-ee-ii =
         CDM-INPUT-ee(sp:ep)
         CALL
         CHREAL(CHAR-ES-VAR-INS-ee-ii,
         ES-VAR-INS-ee-ii, NDMLST)

                where ee = ES-NDML-NO
                      ii = ES-INDEX
                      sp = START-POS
                      ep = END-POS

2.5.5.5  Calculate START-POS = END-POS +
         1.
```

2.6 Generate code for an insert from a user structure.

2.6.1 Generate an internal table to correspond to user's structure.

2.6.1.1 Generate the 01 level of the table if language is COBOL:

01 CDM-INPUT-eee.

where eee = ES-NDML-NO

2.6.1.2 Generate the data definitions for the table containing the insert values. Call function "CDP10E" with the following parameters:

LANG-NO
IDFILE-NAME
FDFILE-NAME
WORKFILE-NAME
PROCFILE-NAME
ES-ACTION-LIST
ES-VALUE-USED
FORTRAN-VARIABLE-TABLE
QCS-CDMP-CHECK-STATUS

2.7 Set LAST-ES-NDML-NO to ES-NDML-NO.

3. Determine the type of Conceptual Schema transaction and update the parcels containing the users application source code.

3.1 If CS-ACTION = "S" (Select) or CS-ACTION = "Q" (Combination Query) go to step 4.

3.2 If CS-ACTION = "M" (Modify) go to step 5.

3.3 If CS-ACTION = "D" (Delete) go to step 6.

3.4 If CS-ACTION = "I" (Insert) go to step 7.

3.5 If CS-ACTION = "1" (Type 1 Referential Integrity) go to step 8.

3.6 If CS-ACTION = "2" (Type 2 Referential Integrity) go to step 9.

3.7 If CS-ACTION = "K" (Key Uniqueness) go to step 10.

3.8 If CS-ACTION = "B" (Begin) go to step 11.

3.9 If CS-ACTION = "C" (Commit) go to step 12.

3.10 If CS-ACTION = "R" (Rollback) go to step 13.

3.11 If CS-ACTION = "N" or (Next or Continue) go to step 14.

3.12 If CS-ACTION = "E" (End Curley) go to step 15.

3.13 If CS-ACTION = "X" (Exit or Break) go to step 16.

4. Process a Select Conceptual Schema transaction.

4.0 If ES-SEMI-CURLY-IND not equal spaces, add an entry to the BLOCK-STACK.

4.0.1 Add 1 to BLOCK-INDEX.

4.0.2 Set MOD-NAME-STACK (BLOCK-INDEX) to CS-ES-MOD-NAME.

4.0.3 Set CS-NDML-NO-STACK (BLOCK-INDEX) to CS-NDML-NO.

4.1 Determine the type of SELECT command:

1. Select retrieved values into a user file.
2. Select retrieved values into a user structure.
3. Select retrieved values into user variables.
4. Inner Select of a Query combination command.

If ES-FILE-NAME NOT = SPACE continue processing at step 4.2.

If ES-STRUCTURE NOT = SPACE or ES-LOCAL-VARIABLE NOT = SPACE continue processing at step 4.3.

If ES-SELECT-COMB continue processing at step 4.4.

4.2 Process a Select where the results are to be stored in a user specified file.

4.2.1 Generate variable containing file name in WS parcel if language is COBOL:

01 CDM-RESULTS-REC-eee

where eee = ES-NDML-NO

4.2.2 Generate variables to hold results

4.2.2.1 Call function "CDP1OF" with the following parameters:

LANG-NO
CS-ACTION-LIST
ES-ACTION-LIST
FDFILE-NAME

WORKFILE-NAME
FORTRAN-VARIABLE-TABLE
QCS-CDMP-CHECK-STATUS

4.2.2.2 If language is COBOL generate:

```
01 CDM-RESULTS-NAME-ee   PIC
                          X(80).
```

else generate:

```
CHARACTER*80
CDM-RESULTS-NAME-ee
```

where ee = ES-NDML-NO

4.2.3 Generates code to transform runtime qualification values from external to conceptual schema format.

Call function CDP1OA with the following parameters:

LANG-NO
FDFILE-NAME
WORKFILE-NAME
PROCFILE-NAME
CS-ACTION-LIST
CS-QUALIFY-LIST
ES-ACTION-LIST
ES-QUALIFY-LIST
IS-ACTION-LIST
IS-QUALIFY-LIST
UV-ABBR-LIST
CODE-GENERATOR-TABLE
SUBTRANS-PROCESS-ID-TABLE
NEXT-PARAMETER-NO
ERROR-FILE
LUW
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS

4.2.4 Generate code to transfer the precompiler tables required at runtime for the Distributed Request Supervisor. Call function "CDP1OB" with the following parameters:

LANG-NO
WORKFILE-NAME
PROCFILE-NAME
ES-NDML-NO
JQG
JQG-ATTRIBUTE-PAIR-LIST
RFT
CS-ACTION-LIST
FORTRAN-VARIABLE-LIST
TARGET-HOST

QCS-CDMP-CHECK-STATUS.

4.2.5 Generate code to call the DRS and receive status back.

4.2.5.1 Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - DRSCALL
Parameters
  P1 = SUB-USED
  P2 = CS-ACTION
  P3 = ES-NDML-NO
  P4 = CS-NDML-NO

Library Name - VAXFORTRAN or
               IBMFORTRAN
Macro Name - DRSCALL
Parameters
  P1 = SUB-USED
  P2 = CS-ACTION
  P3 = CDM-POOL-ee-cc
  P4 = CDM-CSAL-ee-cc
  P5 = CDM-JQG-ee-cc
  P6 = CDM-APL-ee-cc
  P7 = CDM-RFT-ee-cc
  P8 =
CDM-CS-RESULTS-FILE-ee

where ee = ES-NDML-NO
      cc = CS-NDML-NO
```

4.2.5.2 If the CS-ACTION is not BEGIN, COMMIT, or ROLLBACK, call "CDMACR" utility with the following:

```
Library Name - COBOL or
VAXFORTRAN or
IBMFORTRAN
Macro Name - ERRCHK
Parameters
  EE = ES-NDML-NO
```

4.2.6 Generate code to initialize NDML-COUNT for the retrieval loop. Generate if COBOL:

```
MOVE ZERO TO NDML-COUNT.
```

Otherwise, generate:

```
NDMLCT = 0
```

4.2.7 Generate code to call the C/E Transform Program for the first time:

4.2.7.1 Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - CECALL
Parameters
 P1    = 1
 EE    = ES-NDML-NO
 CC    = CS-NDML-NO if
      ES-SEMI-CURLY-IND
      equal spaces, otherwise use
      CS-NDML-NO-STACK (BLOCK-INDEX)
 MMMMM = CS-ES-MOD-NAME if
      ES-SEMI-CURLY-IND
      equal spaces, otherwise use
      MOD-NAME-STACK (BLOCK-INDEX)


Library Name - VAXFORTRAN or
      IBMFORTRAN
Macro Name - CECALL
Parameters
 P1    = '1'
 MMMMM = CS-ES-MOD-NAME if
      ES-SEMI-CURLY-IND equal
      spaces, otherwise use
      MOD-NAME-STACK(BLOCK-INDEX)
 P2    = CDM-CS-RESULTS-FILE-ee
 P3    = CDM-CSQ-TABLE-cc
 P4    = CDM-RESULTS-ee

where ee = ES-NDML-NO
   cc = CS-NDML-NO if
      ES-SEMI-CURLY-IND equal
      spaces, otherwise use
      MOD-NAME-STACK(BLOCK-INDEX)
```

4.2.7.2 If language is COBOL generate:

```
IF NOT CDM-CD-EOF
ADD 1 TO NDML-COUNT.
```

else generate:

```
IF (EOFFLA.NE.'1') NDMLCT =
NDMLCT + 1
```

4.2.7.3 Call "CDMACR" utility with the following:

```
Library Name - COBOL or
VAXFORTRAN or
       IBMFORTRAN
Macro Name - ERRCHKCE
Parameters
  EE = ES-NDML-NO
```

4.2.8 Generate code to move the values in the result record to the named file.

4.2.8.1 Call function CDP10C to generate the moves with the following parameters:

LANG-NO
PROCFILE-NAME
ES-ACTION-LIST
CS-NDML-NO
FORTRAN-VARIABLE-TABLE
QCS-CDMP-CHECK-STATUS

4.2.9 Generate code to save results to a user's file.

4.2.9.1 Generate code to begin saving results into user's file.

Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - FILSAV1
Parameters
  EE = ES-NDML-NO
  F1 = ES-FILE-NAME
  (Variable or Constant)

Library Name - VAXFORTRAN or
IBMFORTRAN
Macro Name - FILSAV1
Parameters
  EE = ES-NDML-NO
  F1 = ES-FILE-NAME
    (Variable or Constant)
  P1 = CDM-RESULTS-NAME-ee
  P2 = FCB-CDM-RESULTS-ee
  P3 = CDM-RECORD-LENGTH-ee

where ee = ES-NDML-NO
```

4.2.10 Generate paragraph name for program loop to save results to a file. Generate if COBOL:

```
LOOP-eee.
```

4.2.11 Generate code to save the null flag values for the retrieved data.

4.2.11.1 If COBOL, for each projected data item in the ES-ACTION-LIST, generate:

```
    MOVE FLAG-X(ii) TO ES-NULL-cc-nn.

where ii = current index into the null
        flag array
cc = ES-NDML-NO
nn = ES-INDEX
```

4.2.11.2.1 Calculate the number of non-deleted ES-ACTION-LIST entries, and set REAL-ES-USED.

4.2.11.2.2 Generate:

```
CDM-RESULTS-REC-ee(
1:rr) =
FLAGAR(1:rr)

where ee =
ES-NDML-NO
     rr =
REAL-ES-USED
```

4.2.12 Generate code to write the results to the user specified file.

4.2.12.1 If COBOL, generate:

```
MOVE CDM-RESULTS-eee TO
         CDM-RESULTS-RECORD-eee.

where eee = ES-NDML-NO
```

4.2.12.2 If FORTRAN, perform steps 4.2.12.2.1 through 4.7.12.2.5 for each projected data item in the ES-ACTION-LIST. Initialize START-POS to 1 and START-POSF to REAL-ES-USED plus 1.

4.2.12.2.1 If ES-FCTN-NAME is "COUNT", perform steps 4.2.12.2.1.1 through 4.2.12.2.1.3.

4.2.12.2.1.1 Set END-POS equal START-POS +8.
Set END-POSF equal START-POSF +8.

4.2.12.2.1.2 Generate:

```
CALL CONDIG
(CDM-RESULTS-ee
(ep:ep), SIGN,
DIGIT, NDMLST)
CDM-RESULTS-REC-
ee
(sf:ef) =
CDM-RESULTS-ee
(sp:ep)
where ee =
ES-NDML-NO
ep = END-POS
```

```
                                    sp = START-POS
                                    ef = END-POSF
                                    sf = START-POSF

                    4.2.12.2.1.3    Set START-POS
                                    equal END-POS
                                    plus 1.
                                    Set START-POSF
                                    equal END-POSF
                                    plus 1.
                                    Continue at step
                                    4.2.12.2.

      4.2.12.2.2    If ES-FCTN-NAME is equal to
                    "MEAN", or "AVG," or "SUM,"
                    perform steps 4.2.12.2.2.1
                    through 4.2.12.2.2.3.

                    4.2.12.2.2.1    Set START-POS
                                    equal START-POS
                                    plus 8.  Set
                                    END-POSF equal
                                    START-POSF plus
                                    18.

                    4.2.12.2.2.2    Generate:
                                    DECIML = 9
                                    CALL RELFTN
                                    (DECIML,
                                    ES-RES-cc-ii,
                                    LONG-ES-RES-cc-i
                                    i,CDM-RESULTS-RE
                                    C-ee
                                    (sf:ef))
                                    where cc =
                                    CS-NDML-NO
                                     ii = ES-INDEX
                                     sf = STAT-POSF
                                     ef = END-POSF
                                     ee = ES-NDML-NO

                    4.2.12.2.2.3    Set START-POSF
                                    equal END-POSF
                                    plus 1.
                                    Continue at step
                                    4.2.12.2.

      4.2.12.2.3    If ES-TYPE equals "I", perform
                    steps 4.2.12.2.3.1 through
                    4.2.12.2.3.3.

                    4.2.12.2.3.1    Set END-POSF
                                    equal START-POSF
                                    plus 9.

                    4.2.12.2.3.2    Generate:
                                    DIGIT =
                                    ES-RES-cc-ii
                                    Call INTFIN
```

(DIGIT,
CDM-RESULTS-REC-
ee
(sf:ef))
where cc =
CS-NDML-NO
ii = ES-INDEX
ee = ES-NDML-NO
sf = START-POSF
ef = END-POSF

4.2.12.2.3.3 Set START-POSF equal END-POSF plus 1.
If ES-SIZE is greater than 4
Set START-POS equal START-POS plus 4.
Else
Set START-POS equal START-POS plus 2.
Continue at step 4.2.12.1.

4.2.12.2.4 If ES-TYPE equals "F", same processing as step 4.2.12.2.2.

4.2.12.2.5 If ES-TYPE equals "C", perform steps 4.2.12.2.5.1 through 4.2.12.2.5.3.

4.2.12.2.5.1 Set END-POSF equal START-POSF plus ES-SIZE minus 1.
Set END-POS equal START-POS plus ES-SIZE minus 1.

4.2.12.2.5.2 Generate:
CDM-RESULTS-REC-
ee (sf:ef) =
CDM-RESULTS-ee(s
p:ep)
where ee =
ES-NDML-NO
sf = START-POSF
ef = END-POSF
sp = START-POS
ep = END-POS

4.2.12.2.5.3 Set START-POS equal END-POS plus 1.

```
                                  Set START-POSF
                                  equal END-POSF
                                  plus 1.
                                  Continue at step
                                  4.2.12.2.

              4.2.12.3 Call "CDMACR" utility with the
                       following:

                       Library Name - COBOL
                       Macro Name - UAPWR
                       Parameters
                         EE = ES-NDML-NO

                       Library Name - VAXFORTRAN or
                       IBMFORTRAN
                       Macro Name - UAPWR
                       Parameters
                         P1 = FCB-CDM-RESULTS-ee
                         P2 = CDM-RESULTS-REC-ee
                         P3 = CDM-RECORD-LENGTH-ee
                       where ee = ES-NDML-NO

        4.2.13 Generate code to call the C/E Transform
               Program for the 2-N time.

               4.2.13.1 Call "CDMACR" utility with the
               following:

              Library Name - COBOL
              Macro Name - CECALL
              Parameters
                P1    = 2
                EE    = ES-NDML-NO
                CC    = CS-NDML-NO if ES-SEMI-CURLY-IND
                        equal spaces, otherwise use
                        CS-NDML-NO-STACK (BLOCK-INDEX)
                MMMMM = CS-ES-MOD-NAME if
                        ES-SEMI-CURLY-IND
                        equal spaces, otherwise use
                        MOD-NAME-STACK (BLOCK-INDEX)

              Library Name - VAXFORTRAN or IBMFORTRAN
              Macro Name - CECALL
              Parameters
                P1    = '2'
                MMMMM = CS-ES-MOD-NAME if
                        ES-SEMI-CURLY-IND equal spaces,
                        otherwise use MOD-NAME-STACK
                        (BLOCK-INDEX)
                P2    = CDM-RESULTS-FILE-ee
                P3    = CDM-CSQ-TABLE-cc
                P4    = CDM-RESULTS-ee
             where ee = ES-NDML-NO
                   cc = CS-NDML-NO if ES-SEMI-CURLY-IND
                        equal spaces, otherwise use
                        MOD-NAME-STACK (BLOCK-INDEX)

              4.2.13.2 If language is COBOL, generate:
```

```
IF NOT CDM-CE-EOF
ADD 1 TO NDML-COUNT.
```

else generate:

```
IF (EOFFLA.NE.'1') NDMLCT =
NDMLCT +1
```

4.2.13.3 Call "CDMACR" utility with the following:

Library Name = COBOL or
VAXFORTRAN or
IBMFORTRAN
Macro Name = ERRCHK
Parameters
EE = ES-NDML-NO

4.2.14 Generate code to move the values in the result record to the named variables, structure or file.

4.2.14.1 Call function CDP10C to generate the moves with the following parameters:

LANG-NO
PROCFILE-NAME
ES-ACTION-LIST
CS-NDML-NO
FORTRAN-VARIABLE-TABLE
QCS-CDMP-CHECK-STATUS

4.2.15 Generate code for completion of the loop for saving results into a file. Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - FILSAV2
Parameters
  EE = ES-NDML-NO

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - FILSAV2
Parameters
  EE = ES-NDML-NO
  P1 = FCB-CDM-RESULTS-ee
where ee = ES-NDML-NO
```

4.2.16 Continue processing at step 17.

4.3 Process a Select where the results are to be stored in a user specified structure or user variables.

4.3.1 Generate working storage definition for the 01 level of the results. Generate if COBOL:

```
01  CDM-RESULTS-eee.
```

where eee = ES-NDML-NO

4.3.2 Generate variables to hold results.

Call function CDP10F with the following parameters:

LANG-NO
CS-ACTION-LIST
ES-ACTION-LIST
FDFILE-NAME
WORKFILE-NAME
FORTRAN-VARIABLE-TABLE
QCS-CDMP-CHECK-STATUS

4.3.3 Generate code to transform runtime qualification values from External to Conceptual Schema format.

Call function CDP10A with the following parameters:

LANG-NO
FDFILE-NAME
WORKFILE-NAME
PROCFILE-NAME
CS-ACTION-LIST
CS-QUALIFY-LIST
ES-ACTION-LIST
ES-QUALIFY-LIST
IS-ACTION-LIST
IS-QUALIFY-LIST
UV-ABBR-LIST
CODE-GENERATOR-TABLE
SUBTRANS-PROCESS-ID-TABLE
NEXT-PARAMETER-NO
ERROR-FILE
LUW
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS

4.3.4 Generate code to transfer the precompiler tables required at runtime for the Distributed Request Supervisor.

Call function CDP10B with the following parameters:

LANG-NO
WORKFILE-NAME
PROCFILE-NAME
ES-NDML-NO

JQG
JQG-ATTRIBUTE-PAIR-LIST
RFT
CS-ACTION-LIST
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS

4.3.5 Generate code to call the DRS and receive status back.

4.3.5.1 Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - DRSCALL
Parameters
  P1 = SUB-USED
  P2 = CS-ACTION
  P3 = ES-NDML-NO
  P4 = CS-NDML-NO

Library Name - VAXFORTRAN or
IBMFORTRAN
Macro Name - DRSCALL
Parameters
  P1 = SUB-USED
  P2 = CS-ACTION
  P3 = CDM-POOL-ee-cc
  P4 = CDM-CSAL-ee-cc
  P5 = CDM-JQG-ee-cc
  P6 = CDM-APL-ee-cc
  P7 = CDM-RFT-ee-cc
  P8 = CDM-CS-RESULTS-FILE-ee

where ee = ES-NDML-NO
      cc = CS-NDML-NO
```

4.3.5.2 Call "CDMACR" utility with the following:

```
Library Name - COBOL or
VAXFORTRAN or IBMFORTRAN
Macro Name - ERRCHK
Parameters
  EE = ES-NDML-NO
```

4.3.6 Generate code to bypass the call to the C/E transform program if no results were retrieved. Generate if COBOL:

```
IF NDML-COUNT = 0
GO TO END-NDML-eee.
```

else generate:

```
IF (CHARCT.EQ. '00000') GO TO 93eee
```

where eee = NDML-NO

4.3.7 Generate code to initialize NDML-COUNT for the retrieval loop. Generate if COBOL:

```
MOVE ZERO TO NDML-COUNT.
```

else generate:

```
NDMLCT = 0
```

4.3.8 Generate code to call the C/E Transform Program for the first time.

4.3.8.1 Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - CECALL
Parameters
  P1    = 1
  EE    = ES-NDML-NO
  CC    = CS-NDML-NO if
       ES-SEMI-CURLY-IND equal
       spaces, otherwise use
CS-NDML-NO-STACK
(BLOCK-INDEX)

  MMMMM = CS-ES-MOD-NAME if
       ES-SEMI-CURLY-IND
       equal spaces, otherwise
       use MOD-NAME-STACK
       (BLOCK-INDEX)

Library Name - VAXFORTRAN or
IBMFORTRAN
Macro Name - CECALL
Parameters
  P1 = '1'
MMMMM = CS-ES-MOD-NAME if
ES-SEMI-CURLY-IND
       equal spaces, otherwise
use MOD-NAME-STACK
(BLOCK-INDEX)
  P2 = CDM-CS-RESULTS-FILE-ee
  P3 = CDM-CSQ-TABLE-cc
  P4 = CDM-RESULTS-ee

where ee = ES-NDML-NO
      cc = CS-NDML-NO if
       ES-SEMI-CURLY-IND
       equal spaces, otherwise
       use CS-NDML-NO-STACK
       (BLOCK-INDEX)
```

4.3.8.2 If language is COBOL, generate:

```
IF NOT CDM-CD-EOF
ADD 1 TO NDML-COUNT.
```

else generate:

```
IF (EOFFLA.NE.'1') NDMLCT =
NDMLCT +1
```

4.3.8.3 Call 'CDMACR" utility with the following:

```
Library Name - COBOL or
VAXFORTRAN or
                    IBMFORTRAN
Macro Name - ERRCHKCE
Parameters
  EE = ES-NDML-NO
```

4.3.9 Generate code to move the values in the result record to the named variables, structure or file.

4.3.9.1 Generate paragraph name for program loop of saving results. Generate if COBOL:

```
LOOP-eee.
```

else generate:

```
94eee
```

where eee = ES-NDML-NO

4.3.9.2 Call function "CDP10C" to generate the moves with the following parameters:

```
LANG-NO
PROCFILE-NAME
ES-ACTION-LIST
CS-NDML-NO
FORTRAN-VARIABLE-TABLE
QCS-CDMP-CHECK-STATUS
```

4.3.10 Generate code to close and delete the results file and teminate the loop structure for SELECT into variables or structure that did not have an NDML loop structure.

If ES-SEMI-CURLY-IND equal spaces generate code to call the C/E Transform Program to close and delete the results file.

4.3.10.1 Call "CDMACR" utility with the following:

```
      Library Name - COBOL
      Macro Name - CECALL
      Parameters
P1    = 3
EE    = ES-NDML-NO
CC    = CS-NDML-NO if ES-SEMI-CURLY-IND equal
             spaces, otherwise use
             CS-NDML-NO-STACK(BLOCK-INDEX)
```

```
  MMMMM = CS-ES-MOD-NAME if
ES-SEMI-CURLY-IND
          equal spaces otherwise use
          MOD-NAME-STACK(BLOCK-INDEX)

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - CECALL
Parameters
  P1 = '3'
  MMMMM = CS-ES-MOD-NAME if
ES-SEMI-CURLY-IND
          equal spaces, otherwise use
MOD-NAME-STACK (BLOCK-INDEX)
  P2    = CDM-CS-RESULTS-FILE-ee
  P3    = CDM-CSQ-TABLE-cc
  P4    = CDM-RESULTS-ee

where ee = ES-NDML-NO
      cc = CS-NDML-NO if ES-SEMI-CURLY-IND
           equal spaces, otherwise use
CS-NDML-NO-STACK (BLOCK-INDEX)
```

4.3.10.2 Call "CDMACR" utility with the following:

```
Library Name - COBOL or VAXFORTRAN or
               IBMFORTRAN
Macro Name - ERRCHK
Parameters
  EE = ES-NDML-NO
```

4.3.10.3 If ES-SEMI-CURLY-IND equal space generate closing loop structure. Generate if COBOL:

```
END-NDML-eee.
```

else generate:

```
93eee
```

where eee = ES-NDML-NO

4.3.11 Continue processing at step 17.

4.4 Process an inner select of a Query combination command.

4.4.1 Determine if each inner Select has the same number of attributes to be retrieved and if each attribute matches in data type.

4.4.1.1 Determine if this is first inner Select for Query combination command, and if it is, then populate SAVE-CS-ACTION-LIST.

If FIRST-INNER-SELECT flag is not set, calculate REAL-CS-USED by counting only CS-ENTRIES that are not generated or have not been deleted. Transfer REAL-CS-USED to SAVE-CS-USED and transfer each used

CS-TYPE to SAVE-CS-TYPE. Set the FIRST-INNER-SELECT flag to indicate we have processed the first inner Select of the Query combination command.

If FIRST-INNER-SELECT flag has been set, just calculate REAL-CS-USED by the method described in tne above paragraph.

4.4.1.2 Check to see that the number of attributes match.

If REAL-CS-USED NOT = SAVE-CS-USED issue an error message, set function status to bad status and exit processing of CDP10.

4.4.1.3 Check to see that the data type of each attribute matches.

For each used entry in the CS-ACTION-LIST if CS-TYPE NOT = SAVE-CS-TYPE issue an error
message, set function status to bad status and exit processing of CDP10.

4.4.2 Generate working storage variables to hold the names of result files from DRS and CS selector and CS count. Generate if COBOL:

```
01  CDM-CS-RESULTS-eee        PIC X(80).
01  CDM-CS-COUNT-eee          PIC 9(6).
```

else generate:

```
CHARACTER*80   CDM-CS-RESULTS-eee
CHARACTER*6    CDM-CS-COUNT-eee
```

where eee = CS-NDML-NO

4.4.3 Generate code to transform runtime qualification values from External to Conceptual Schema format. Call function CDP10A with the following parameters:

```
LANG-NO
FDFILE-NAME
WORKFILE-NAME
PROCFILE-NAME
CS-ACTION-LIST
CS-QUALIFY-LIST
ES-ACTION-LIST
ES-QUALIFY-LIST
IS-ACTION-LIST
IS-QUALIFY-LIST
UV-ABBR-LIST
CODE-GENERATOR-TABLE
SUBTRANS-PROCESS-ID-TABLE
NEXT-PARAMETER-NO
ERROR-FILE
LUW
```

FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS

4.4.4 Generate code to transfer the precompiler tables required at runtime for the Distributed Request Supervisor.

Call function CDP10B with the following parameters:

LANG-NO
WORKFILE-NAME
PROCFILE-NAME
ES-NDML-NO
JQG
JQG-ATTRIBUTE-PAIR-LIST
RFT
CS-ACTION-LIST
FORTRAN-VARIABLE-TABLE
QCS-CDM-CHECK-STATUS

4.4.5 Generate code to call the DRS and receive status back.

4.4.5.1 Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - DRSCALL
Parameters
  P1 = SUB-USED
  P2 = CS-ACTION
  P3 = ES-NDML-NO
  P4 = CS-NDML-NO

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - DRSCALL
Parameters
  P1 = SUB-USED
  P2 = CS-ACTION
  P3 = CDM-POOL-ee-cc
  P4 = CDM-CSAL-ee-cc
  P5 = CDM-JQG-ee-cc
  P6 = CDM-APL-ee-cc
  P7 = CDM-RFT-ee-cc
  P8 = CDM-CS-RESULTS-FILE-ee
where  ee = ES-NDML-NO
       cc = CS-NDML-NO
```

4.4.5.2 Call "CDMACR" utility with the following:

```
Library Name - COBOL or VAXFORTRAN or
               IBMFORTRAN
Macro Name - ERRCHK
Parameters
  EE = ES-NDML-NO
```

4.4.6 Generate code to call the CS selector program to obtain the final file of Conceptual Schema results. Call the "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - CCCALL
Parameters
  P2     = ES-NDML-NO
  P3     = CS-NDML-NO
  P1     = CS-ES-MOD-NAME

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - CCCALL
Parameters
  P1 = CS-ES-MOD-NAME
  P2 = CDM-CS-RESULTS-FILE-ee
  P3 = CDM-CSQ-TABLE-cc
  P4 = CDM-CS-RESULTS-cc
  P5 = CDM-CS-COUNT-cc
where  ee = ES-NDML-NO
       cc = CS-NDML-NO
```

4.4.7 Generate code to perform error checking for the C/C transformer call. Call the "CDMACR" utility with the following:

```
Library Name - COBOL or VAXFORTRAN or IBMFORTRAN
Macro Name - ERRCHK
Parameters
  EE = ES-NDML-NO
```

4.4.8 Continue processing at step 17.

5. Process a Modify Conceptual Schema transaction.

5.1 Generates code to transform runtime qualification/update values from External to Conceptual Schema format. Call function CDP10A with the following parameters:

```
LANG-NO
FDFILE-NAME
WORKFILE-NAME
PROCFILE-NAME
CS-ACTION-LIST
CS-QUALIFY-LIST
ES-ACTION-LIST
ES-QUALIFY-LIST
IS-ACTION-LIST
IS-QUALIFY-LIST
UV-ABBR-LIST
CODE-GENERATOR-TABLE
SUBTRANS-PROCESS-ID-TABLE
NEXT-PARAMETER-NO
ERROR-FILE
LUW
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS
```

5.2 Generate code to test for assertion/constraints. Call function CDCONS with the following parameters:

LANG-NO
CS-ACTION-LIST
CS-QUALIFY-LIST
WORKFILE-NAME
PROCFILE-NAME
NEXT-PARAMETER-NO
ES-NDML-NO
ERROR-FILE
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS

5.3 Generate code to transfer the precompiler tables required at runtime for the Distributed Request Supervisor. Call function CDP10B with the following parameters:

LANG-NO
WORKFILE-NAME
PROCFILE-NAME
ES-NDML-NO
JQG
JQG-ATTRIBUTE-PAIR-LIST
RFT
CS-ACTION-LIST
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS

5.4 Generate code to call the DRS and receive status back.

5.4.1 Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - DRSCALL
Parameters
   P1 = SUB-USED
   P2 = CS-ACTION
   P3 = ES-NDML-NO
   P4 = CS-NDML-NO

Library Name - VAXFORTRAN or IBMFORTRAN

Macro Name - DRSCALL
  P1 = SUB-USED
  P2 = CS-ACTION
  P3 = CDM-POOL-ee-cc
  P4 = CDM-CSAL-ee-cc
  P5 = CDM-JQG-ee-cc
  P6 = CDM-APL-ee-cc
  P7 = CDM-RFT-ee-cc
  P8 = CDM-CS-RESULTS-FILE-ee
where  ee = ES-NDML-NO
       cc = CS-NDML-NO
```

5.4.2 Call "CDMACR" utility with the following:

```
                    Library Name - COBOL or
VAXFORTRAN or IBMFORTRAN
                    Macro Name   - ERRCHK
                    Parameters
                       EE = ES-NDML-NO
```

5.5 Generate code to define the bypass point for the command. Generate if COBOL:

```
END-NDML-eee.
```

else generate:

```
93eee
```

where eee = ES-NDML-NO

5.6 Continue processing at step 17.

6. Process a Delete Conceptual Schema transaction.

6.1 Generate code to transform runtime qualification values from External to Conceptual Schema format. Call function CDP10A with the following parameters:

```
LANG-NO
FDFILE-NAME
WORKFILE-NAME
PROCFILE-NAME
CS-ACTION-LIST
CS-QUALIFY-LIST
ES-ACTION-LIST
ES-QUALIFY-LIST
IS-ACTION-LIST
IS-QUALIFY-LIST
UV-ABBR-LIST
CODE-GENERATOR-TABLE
SUBTRANS-PROCESS-ID-TABLE
NEXT-PARAMETER-NO
ERROR-FILE
LUW
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS
```

6.2 Generate code to test for assertion/constraints. Call function CDCONS with the following parameters:

```
LANG-NO
CS-ACTION-LIST
CS-QUALIFY-LIST
WORKFILE-NAME
PROCFILE-NAME
```

```
NEXT-PARAMETER-NO
ES-NDML-NO
ERROR-FILE
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS
```

6.3 Generate code to transfer the precompiler tables required at runtime for the distributed request supervisor. Call function CDP10B with the following parameters:

```
LANG-NO
WORKFILE-NAME
PROCFILE-NAME
ES-NDML-NO
JQG
JQG-ATTRIBUTE-PAIR-LIST
RFT
CS-ACTION-LIST
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS
```

6.4 Generate code to call the DRS and receive status back.

6.4.1 Call "CDMACR" utility with the following:

```
                        Library Name - COBOL
                        Macro Name - DRSCALL
                        Parameters
                  P1 = SUB-USED
                  P2 = CS-ACTION
                  P3 = ES-NDML-NO
                  P4 = CS-NDML-NO
Library Name - VAXFORTRAN or IBMFORTRAN
       Macro Name - DRSCALL
       P1 = SUB-USED
       P2 = CS-ACTION
       P3 = CDM-POOL-ee-cc
       P4 = CDM-CSAL-ee-cc
       P5 = CDM-JQG-ee-cc
       P6 = CDM-APL-ee-cc
       P7 = CDM-RFT-ee-cc
       P8 = CDM-CS-RESULTS-FILE-ee
             where  ee = ES-NDML-NO
                    cc = CS-NDML-NO
```

6.4.2 Call "CDMACR" utility with the following:

```
Library Name - COBOL or VAXFORTRAN or
IBMFORTRAN
               Macro Name   - ERRCHK
               Parameters
                  EE = ES-NDML-NO
```

6.5 Generate code to define the bypass point for the command. Generate if COBOL:

END-NDML-eee.

else generate:

93eee

where eee = ES-NDML-NO

6.6 Continue processing at step 17.

7. Process an Insert Conceptual Schema transaction.

7.1 Generate code to transform runtime insert values from External to Conceptual Schema format. Call function CDP10A with the following parameters:

```
LANG-NO
FDFILE-NAME
WORKFILE-NAME
PROCFILE-NAME
CS-ACTION-LIST
CS-QUALIFY-LIST
ES-ACTION-LIST
ES-QUALIFY-LIST
IS-ACTION-LIST
IS-QUALIFY-LIST
UV-ABBR-LIST
CODE-GENERATOR-TABLE
SUBTRANS-PROCESS-ID-TABLE
NEXT-PARAMETER-NO
ERROR-FILE
LUW
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS
```

7.2 Generate code to test for assertion/constraints. Call function CDCONS with the following parameters:

```
LANG-NO
CS-ACTION-LIST
CS-QUALIFY-LIST
WORKFILE-NAME
PROCFILE-NAME
NEXT-PARAMETER-NO
ES-NDML-NO
ERROR-FILE
        FORTRAN-VARIABLE-TABLE
        TARGET-HOST
QCS-CDMP-CHECK-STATUS
```

7.3 Generate code to transfer the precompiler tables required at runtime for the Distributed Request Supervisor. Call function CDP10B with the following parameters:

LANG-NO
WORKFILE-NAME
PROCFILE-NAME
ES-NDML-NO
JQG
JQG-ATTRIBUTE-PAIR-LIST
RFT
CS-ACTION-LIST
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS

7.4 Generate code to call the DRS and receive status back.

7.4.1 Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - DRSCALL
Parameters
   P1 = SUB-USED
   P2 = CS-ACTION
   P3 = ES-NDML-NO
   P4 = CS-NDML-NO
```

```
Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - DRSCALL
Parameters
  P1 = SUB-USED
  P2 = CS-ACTION
         P3 = CDM-POOL-ee-cc
         P4 = CDM-CSAL-ee-cc
         P5 = CDM-JQG-ee-cc
         P6 = CDM-APL-ee-cc
         P7 = CDM-RFT-ee-cc
  P8 = CDM-CS-RESULTS-FILE-ee
where  ee = ES-NDML-NO
              cc = CS-NDML-NO
```

7.4.2 Call "CDMACR" utility with the following:

```
Library Name - COBOL or VAXFORTRAN or
IBMFORTRAN
               Macro Name    - ERRCHK
               Parameters
          EE = ES-NDML-NO
```

7.5 Generate code for the termination of the loop for insert values

7.5.1 If ES-STRUCTURE NOT = SPACE generate if COBOL:

```
END-NDML-eee.
BREAK-NDML-eee.
```

else generate:

```
                93eee
                95eee

                where eee = ES-NDML-NO

                Continue processing at step 7.6.

    7.5.2  If ES-FILE-NAME NOT = SPACE
                MACRO-NAME = INSFIL2
                else
                MACRO-NAME = INSVAL2

                Call "CDMACR" utility with the
           following:

                Library Name - COBOL
                Macro Name - from above
                Parameters
                   EE = ES-NDML-NO

                Library Name - VAXFORTRAN or
           IBMFORTRAN
                Macro Name - from above
                Parameters
                  EE = ES-NDML-NO
                  P1 = FCB-INPUT-ee
                      (if MACRO NAME is INSFIL2)
                where  ee = ES-NDML-NO

  7.6  Continue processing at step 17.
```

8. Process a Referential Integrity Type 1 Conceptual Schema transaction.

8.1 Generate code to transform runtime qualification value from External to Conceptual Schema format. Call

function CDP10A with the following parameters:

LANG-NO
FDFILE-NAME
WORKFILE-NAME
PROCFILE-NAME
CS-ACTION-LIST
CS-QUALIFY-LIST
ES-ACTION-LIST
ES-QUALIFY-LIST
IS-ACTION-LIST
IS-QUALIFY-LIST
UV-ABBR-LIST
CODE-GENERATOR-TABLE
SUBTRANS-PROCESS-ID-TABLE
NEXT-PARAMETER-NO
ERROR-FILE
LUW
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS

8.2 Generate code to transfer the precompiler tables required at runtime for the Distributed Request Supervisor. Call function CDP10B with the following parameters:

LANG-NO
WORKFILE-NAME
PROCFILE-NAME
ES-NDML-NO
JQG
JQG-ATTRIBUTE-PAIR-LIST
RFT
CS-ACTION-LIST
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS

8.3 Generate code to call the DRS and receive status back.

8.3.1 Call "CDMACR" utility with the following:

Library Name - COBOL
Macro Name - DRSCALL
Parameters
P1 = SUB-USED
P2 = CS-ACTION
P3 = ES-NDML-NO
P4 = CS-NDML-NO

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - DRSCALL
Parameters
P1 = SUB-USED
P2 = CS-ACTION
P3 = CDM-POOL-ee-cc
P4 = CDM-CSAL-ee-cc
P5 = CDM-JQG-ee-cc
P6 = CDM-APL-ee-cc
P7 = CDM-RFT-ee-cc
P8 = CDM-CS-RESULTS-FILE-ee
where ee = ES-NDML-NO
cc = CS-NDML-NO

8.3.2 Call "CDMACR" utility with the following:

Library Name - COBOL or VAXFORTRAN or IBMFORTRAN
Macro Name - ERRCHK
Parameters
EE = ES-NDML-NO

8.4 Generate code to call the CS selector program to obtain the final count of results from the Referential Integrity Type 1 transaction. Call "CDMACR" utility with the following:

Library Name - COBOL
Macro Name - CS2CALL
Parameters
P1 = CS-ES-MOD-NAME
P2 = ES-NDML-NO
P3 = CS-NDML-NO

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - CS2CALL
Parameters
P1 = CS-ES-MOD-NAME
P2 = ES-NDML-NO
P3 = CDM-CS-RESULTS-FILE-ee
P4 = CDM-CSQ-TABLE-cc
where ee = ES-NDML-NO
cc = CS-NDML-NO

8.5 Generate code for the test of the results of a Referential Integrity Type 1 test. Call "CDMACR" utility with the following:

Library Name - COBOL or VAXFORTRAN or IBMFORTRAN
Macro Name - RITCHK
Parameters
OP = SPACE
SIGN = "=" if COBOL
".EQ." if FORTRAN
EE = ES-NDML-NO
ECODE = 49901

8.6 Continue processing at step 17.

9. Process a Referential Integrity Type 2 Conceptual Schema transaction.

9.1 Generate code to transfer runtime qualification values from External to Conceptual Schema format. Call function CDP10A with the following parameters:

LANG-NO
FDFILE-NAME
WORKFILE-NAME
PROCFILE-NAME
CS-ACTION-LIST
CS-QUALIFY-LIST
ES-ACTION-LIST
ES-QUALIFY-LIST
IS-ACTION-LIST
IS-QUALIFY-LIST
UV-ABBR-LIST
CODE-GENERATOR-TABLE
SUBTRANS-PROCESS-ID-TABLE
NEXT-PARAMETER-NO
ERROR-FILE
LUW
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS

9.2 Generate code to transfer the precompiler tables required at runtime for the Distributed Request Supervisor. Call function CDP10B with the following parameters:

```
LANG-NO
WORKFILE-NAME
PROCFILE-NAME
ES-NDML-NO
JQG
JQG-ATTRIBUTE-PAIR-LIST
RFT
CS-ACTION-LIST
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS
```

9.3 Generate code to call the DRS and receive status back.

9.3.1 Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - DRSCALL
Parameters
  P1 = SUB-USED
  P2 = CS-ACTION
  P3 = ES-NDML-NO
  P4 = CS-NDML-NO

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - DRSCALL
Parameters
  P1 = SUB-USED
  P2 = CS-ACTION
  P3 = CDM-POOL-ee-cc
  P4 = CDM-CSAL-ee-cc
  P5 = CDM-JQG-ee-cc
  P6 = CDM-APL-ee-cc
  P7 = CDM-RFT-ee-cc
  P8 = CDM-CS-RESULTS-FILE-ee
where  ee = ES-NDML-NO
       cc = CS-NDML-NO
```

9.3.2 Call "CDMACR" utility with the following:

```
Library Name - COBOL or VAXFORTRAN or
                         IBMFORTRAN
Macro Name    - ERRCHK
Parameters
   EE = ES-NDML-NO
```

9.4 Generate code to call the CS selector program to obtain the final count of results from the Referential Integrity Type 2 transaction. Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - CS2CALL
Parameters
  P1 = CS-ES-MOD-NAME
  P2 = ES-NDML-NO
  P3 = CS-NDML-NO

Library Name -VAXFORTRAN or
        IBMFORTRAN
Macro Name - CS2CALL
Parameters
  P1 = CS-ES-MOD-NAME
  P2 = ES-NDML-NO
  P3 = CDM-CS-RESULTS-FILE-ee
  P4 = CDM-CSQ-TABLE-cc
where  ee = ES-NDML-NO
       cc = CS-NDML-NO
```

9.5 Generate code for the test of the results of a Referential Integrity Type 2 test. Call "CDMACR" utility with the following:

```
Library Name - COBOL or VAXFORTRAN or
        IBMFORTRAN
Macro Name - RITCHK
Parameters
OP     = "NOT" if COBOL
         spaces if FORTRAN
SIGN   = "=" if COBOL
         ".NE." if FORTRAN
EE     = ES-NDML-NO
ECODE  = 49902
```

9.6 Continue processing at step 17.

10. Process a Key Uniqueness Conceptual Schema transaction.

10.1 Generate code to transform runtime qualification values from external to conceptual schema format. Call function CDP10A with the following parameters:

```
LANG-NO
FDFILE-NAME
WORKFILE-NAME
PROCFILE-NAME
CS-ACTION-LIST
CS-QUALIFY-LIST
ES-ACTION-LIST
ES-QUALIFY-LIST
ES-ACTION-LIST
IS-QUALIFY-LIST
UV-ABBR-LIST
CODE-GENERATOR-TABLE
SUBTRANS-PROCESS-ID-TABLE
NEXT-PARAMETER-NO
ERROR-FILE
LUW
```

FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS

10.2 Generate code to transfer the precompiler tables required at runtime for the Distributed Request Supervisor. Call function CDP10B with the following parameters:

LANG-NO
WORKFILE-NAME
PROCFILE-NAME
ES-NDML-NO
JQG
JQG-ATTRIBUTE-PAIR-LIST
RFT
CS-ACTION-LIST
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS

10.3 Generate code to call the DRS and receive status back.

10.3.1 Call "CDMACR" utility with the following:

Library Name - COBOL
Macro Name - DRSCALL
Parameters
P1 = SUB-USED
P2 = CS-ACTION
P3 = ES-NDML-NO
P4 = CS-NDML-NO

Library Name -
VAXFORTRAN or IBMFORTRAN
Macro Name -
DRSCALL
Parameters
P1 = SUB-USED
P2 = CS-ACTION
P3 =
CDM-POOL-ee-cc
P4 =
CDM-CSAL-ee-cc
P5 =
CDM-JQG-ee-cc
P6 =
CDM-APL-ee-cc
P7 =
CDM-RFT-ee-cc
P8 =
CDM-CS-RESULTS-FILE-ee
where ee
= ES-NDML-NO
cc =
CS-NDML-NO

10.3.2 Call "CDMACR" utility with the following:

```
Library Name - COBOL or VAXFORTRAN or
               IBMFORTRAN
Macro Name   - ERRCHK
Parameters
EE = ES-NDML-NO
```

10.4 Generate code to call the CS selector program to obtain the final count of results from the Key Uniqueness Referential Integrity transaction. Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - CS2CALL
Parameters
  P1 = CS-ES-MOD-NAME
  P2 = ES-NDML-NO
  P3 = CS-NDML-NO

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - CS2CALL
Parameters
  P1 = CS-ES-MOD-NAME
  P2 = ES-NDML-NO
  P3 = CDM-CS-RESULTS-FILE-ee
  P4 = CDM-CSQ-TABLE-cc
where ee = ES-NDML-NO
      cc = CS-NDML-NO
```

10.5 Generate code for the test of the results of a Key Uniqueness test. Call "CDMACR" utility with the following:

```
        Library Name - COBOL or VAXFORTRAN or
IBMFORTRAN
        Macro Name - RITCHK
        Parameters
          OP    = "NOT" if COBOL
              spaces if FORTRAN
          SIGN  = "=" if COBOL
              ".NE." if FORTRAN
          EE    = ES-NDML-NO
          ECODE = 49903
```

10.6 Continue processing at step 17.

11. Process a Begin Conceptual Schema transaction.

11.1 Generate code to transfer the precompiler tables required at runtime for the Distributed Request Supervisor. Call function CDP10F with the following parameters:

```
LANG-NO
WORKFILE-NAME
PROCFILE-NAME
ES-NDML-NO
```

```
JQG
JQG-ATTRIBUTE-PAIR-LIST
RFT
CS-ACTION-LIST
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS
```

11.2 Generate code to call the DRS and receive status back. Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - DRSCALL
Parameters
  P1 = SUB-USED
  P2 = CS-ACTION
  P3 = ES-NDML-NO
  P4 = CS-NDML-NO
Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - DRSCALL
Parameters
  P1 = SUB-USED
  P2 = CS-ACTION
        P3 = CDM-POOL-ee-cc
        P4 = CDM-CSAL-ee-cc
        P5 = CDM-JQG-ee-cc
        P6 = CDM-APL-ee-cc
        P7 = CDM-RFT-ee-cc
        P8 = CDM-CS-RESULTS-FILE-ee
        where  ee = ES-NDML-NO
               cc = CS-NDML-NO
```

11.3 Continue processing at step 17.

12. Process a Commit transaction.

12.1 Generate code to transfer the precompiler tables required at runtime for the Distributed Request Supervisor. Call function CDP10B with the following parameters:

```
LANG-NO
WORKFILE-NAME
PROCFILE-NAME
ES-NDML-NO
JQG
JQG-ATTRIBUTE-PAIR-LIST
RFT
CS-ACTION-LIST
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS
```

12.2 Generate code to call the DRS and receive status back. Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - DRSCALL
Parameters
```

```
                P1 = SUB-USED
                P2 = CS-ACTION
                P3 = ES-NDML-NO
                P4 = CS-NDML-NO
              Library Name - VAXFORTRAN or
                             IBMFORTRAN
              Macro Name - DRSCALL
              Parameters
                      P1 = SUB-USED
                      P2 = CS-ACTION
                      P3 = CDM-POOL-ee-cc
                      P4 = CDM-CSAL-ee-cc
                      P5 = CDM-JQG-ee-cc
                      P6 = CDM-APL-ee-cc
                      P7 = CDM-RFT-ee-cc
                      P8 =
CDM-CS-RESULTS-FILE-ee
                      where  ee = ES-NDML-NO
                             cc = CS-NDML-NO
```

12.3 Continue processing at step 17.

13. Process a Rollback transaction.

13.1 Generate code to transfer the precompiler tables required at runtime for the Distributed Request Supervisor. Call function CDP10B with the following parameters:

```
LANG-NO
WORKFILE-NAME
PROCFILE-NAME
ES-NDML-NO
JQG
JQG-ATTRIBUTE-PAIR-LIST
RFT
CS-ACTION-LIST
FORTRAN-VARIABLE-TABLE
TARGET-HOST
QCS-CDMP-CHECK-STATUS
```

13.2 Generate code to call the DRS and receive status back. Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - DRSCALL
Parameters
  P1 = SUB-USED
  P2 = CS-ACTION
  P3 = ES-NDML-NO
  P4 = CS-NDML-NO
Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - DRSCALL
Parameters
  P1 = SUB-USED
  P2 = CS-ACTION
  P3 = CDM-POOL-ee-cc
  P4 = CDM-CSAL-ee-cc
  P5 = CDM-JQG-ee-cc
  P6 = CDM-APL-ee-cc
```

```
                P7 = CDM-RFT-ee-cc
                P8 = CDM-CS-RESULTS-FILE-ee
              where  ee = ES-NDML-NO
                                   cc = CS-NDML-NO
```

13.3 Continue processing at step 17.

14. Process a NEXT/CONTINUE transaction.

Generate code to leave the current retrieval loop.
Generate if COBOL:

```
GO TO CE-LOOP-eee
```

else generate:

```
GO TO 92eee
```

where eee = ES-NDML-NO

Continue processing at step 17.

15. Process an End Curly (E) Conceptual Schema transaction.

15.1 If BLOCK-INDEX = 0
Go to 15.8.

15.2 Generate label for start of retrieval loop.
Generate if COBOL:

```
CE-LOOP-eee.
```

else generate:

```
92eee
```

where eee = ES-NDML-NO

15.3 Generate code to call the C/E transformer for the next record. Call the "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - CECALL
Parameters
  P1    = 2
  EE    = ES-NDML-NO
  CC    = CS-NDML-NO-STACK(BLOCK-INDEX)
  MMMMM = MOD-NAME-STACK(BLOCK-INDEX)
Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - CECALL
Parameters
P1    = '2'
MMMMM = MOD-NAME-STACK(BLOCK-INDEX)
P2    = CDM-CS-RESULTS-FILE-ee
P3    = CDM-CSQ-TABLE-cc
P4    = CDM-RESULTS-ee
where  ee = ES-NDML-NO
       cc = CS-NDML-NO-STACK(BLOCK-INDEX)
```

15.4 If language is COBOL generate:

```
IF NOT CDM-CE-EOF
ADD 1 TO NDML-COUNT.
```

else generate:

```
If (EDFFLA.NE. '1') NDMLCT = NDMLCT + 1
```

15.5 Generate code to perform error checking for the C/E transformer call. Call the "CDMACR" utility with the following:

```
Library Name - COBOL or VAXFORTRAN or
        IBMFORTRAN
Macro Name - ERRCHK
Parameters
  EE = ES-NDML-NO
```

15.6 Generate code to terminate the retrieval loop, the break point and the bypass point. Call "CDMACR" utility with the following:

```
Library Name - COBOL or VAXFORTRAN or
IBMFORTRAN
Macro Name - ENDLOOP
Parameters
  EE = ES-NDML-NO
```

15.7 Subtract 1 from BLOCK-INDEX

15.8 Continue processing at step 17.

16. Process an EXIT or BREAK transaction.

16.1 If BLOCK-INDEX = 0
Go to 17.

16.2 Generate code to call the C/E transformer to close all files. Call the "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - CECALL
Parameters
  P1    = 3
  EE    = ES-NDML-NO
  CC    = CS-NDML-NO-STACK(BLOCK-INDEX)
  MMMMM = MOD-NAME-STACK(BLOCK-INDEX)
Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - CECALL
Parameters
P1    = '3'
MMMMM = MOD-NAME-STACK(BLOCK-INDEX)
P2    = CDM-CS-RESULTS-FILE-ee
P3    = CDM-CSQ-TABLE-cc
P4    = CDM-RESULTS-ee
where  ee = ES-NDML-NO
cc = CS-NDML-NO-STACK(BLOCK-INDEX)
```

16.3 Generate code to exit the retrieval loop.
Generate if COBOL:

```
GO TO BREAK-eee

else generate:

GO TO 91eee

where eee = ES-NDML-NO
```

17. Terminate processing of function PRE10.

    17.1 Close the four parcels of the user's application program.

    17.2 Set the function status variable and exit processing.

27.5 Outputs

1. Error status of the function

   RETURN-STATUS

2. Code generated into the parcels of the Application Program.

```
LIBRARY NAME - COBOL

MACRO NAME - CECALL

PARAMETERS - P1
             EE
             MMMMM
*
*    CALL CS-ES-TRANSFORM
*
      MOVE P1 TO CDM-CE-FLAG
      CALL "MMMMM" USING
             CDM-CE-FLAG
             CDM-CS-RESULTS-FILE-EE
             CDM-CSQ-TABLE-CC
             CDM-FLAG-ARRAY
             CDM-RESULTS-EE
             CDM-CE-EOF-FLAG
             NDML-STATUS
```

```
LIBRARY NAME - COBOL

MACRO NAME - DRSCALL

PARAMETERS - P1
             P2
             P3
             P4

*
*    CALL THE DRS:
*
      MOVE P1 TO CDM-NO-SUBTRANS
      MOVE "P2" TO CDM-DRS-ACTION
      CALL "CDS01" USING
                CDM-NO-SUBTRANS
                CDM-DRS-ACTION
                CDM-POOL-P3-P4
                CDM-CSAL-P3-P4
                CDM-JQG-P3-P4
                CDM-APL-P3-P4
                CDM-RFT-P3-P4
*
                CDM-CS-RESULTS-FILE-P3
                NDML-COUNT
                NDML-STATUS
```

LIBRARY NAME - COBOL

MACRO NAME- ENDLOOP

PARAMETERS - EE

```
*
*    TERMINATION OF RETRIEVAL LOOP
*
      IF NOT CDM-CE-EOF
       GO TO LOOP-EE.
 BREAK-EE.
 END-NDML-EE.
```

LIBRARY NAME - COBOL

MACRO NAME - ERRCHK

PARAMETERS - EE

```
     IF NOT OK
         GO TO END-NDML-EE.
```

LIBRARY NAME - COBOL

MACRO NAME - ERRCHKCE

PARAMETERS - EE

```
     IF NOT OK OR CDM-CE-EOF
        GO TO END-NDML-EE.
```

LIRARY NAME - COBOL

MACRO NAME - FILSAV1

PARAMETERS - EE

```
*
*    BEGIN SAVING RESULTS INTO USERS FILE
*
     IF CDM-CE-EOF
          GO TO END-NDML-EE.
     MOVE F1 TO CDM-RESULTS-NAME-EE.
     MOVE "W" TO DISPOSITION.
     CALL "OPNFIL" USING FCB-CDM-RESULTS-EE,
               RET-STATUS,
               CDM-RESULTS-NAME-EE,
               DISPOSITION,
               CDM-RECORD-LENGTH-EE,
               NUMBER-OF-RECORDS.
     IF RET-STATUS NOT = KES-FILE-OK
          MOVE "ERROR OPENING FILE CDM-RESULTS-NAME-EE"
                TO MESG-DESC
          PERFORM PROCESS-ERROR
          GO TO EXIT-PROGRAM.
```

```
LIBRARY NAME - COBOL

MACRO NAME - FILSAV2

PARAMETERS - EE
*
*    COMPLETION OF LOOP SAVING RESULTS INFO A FILE
*
        IF NOT CDM-CE-EOF
           GO TO LOOP-EE.
        MOVE "K" TO DISPOSITION.
        CALL "CLSFIL" USING FCB-CDM-RESULTS-EE,
                            RET-STATUS,
                            DISPOSITION.
     IF RET-STATUS NOT = KES-FILE-OK
        MOVE "ERROR CLOSING FILE CDM-RESULTS-NAME-EE"
              TO MESG-DESC
        PERFORM PROCESS-ERROR
        GO TO EXIT-PROGRAM.
END-NDML-EE.
```

LIBRARY NAME - COBOL

MACRO NAME - INSFIL1

PARAMETERS - EE
             F1

```
*
*    BEGINNING OF LOOP OF INSERT FROM A FILE
*
     MOVE F1 TO CDM-INPUT-NAME-EE.
     MOVE "R" TO DISPOSITION.
     CALL "OPNFIL" USING FCB-INPUT-EE,
                         RET-STATUS,
                         CDM-INPUT-NAME-EE,
                         DISPOSITION,
                         CDM-INPUT-RECORD-LENGTH-EE,
                         NUMBER-OF-RECORDS.
     IF RET-STATUS NOT = KES-FILE-OK
          MOVE "ERROR OPENING FILE CDM-INPUT-NAME-EE"
               TO MESG-DESC
          PERFORM PROCESS-ERROR
          GO TO EXIT-PROGRAM.
LOOP-EE.
     CALL "INPFIL" USING FCB-INPUT-EE,
               RET-STATUS,
               CDM-INPUT-EE,
               CDM-INPUT-RECORD-LENGTH-EE,
               CDM-INPUT-RETURN-LENGTH-EE.
     IF RET-STATUS = KES-END-OF-FILE-INPUT
          GO TO BREAK-EE.
     IF RET-STATUS NOT = KES-FILE-OK
          MOVE "ERROR READING FILE CDM-INPUT-NAME-EE"
               TO MESG-DESC
          PERFORM PROCESS-ERROR
          GO TO EXIT-PROGRAM.
```

LIBRARY NAME - COBOL

MACRO NAME - INSFIL2

PARAMETERS - EE

```
*
*    END OF INSERT LOOP (FROM FILE)
*
 END-NDML-EE.
     GO TO LOOP-EE.
 BREAK-EE.
     MOVE "K" TO DISPOSITION.
     CALL "CLSFIL" USING FCB-INPUT-EE,
               RET-STATUS,
               DISPOSITION.
     IF RET-STATUS NOT = KES-FILE-OK
          MOVE "ERROR CLOSING FILE CDM-INPUT-EE"
              TO MESG-DESC
        PERFORM PROCESS-ERROR
        GO TO EXIT-PROGRAM.
```

LIBRARY NAME - COBOL

MACRO NAME - INSVAL1

PARAMETERS - EE

```
*
*    BEGINNING OF LOOP TO INSERT COMMAND VALUES
*
     MOVE 0 TO CDM-INPUT-INDEX-EE.
 LOOP-EE.
     ADD 1 TO CDM-INPUT-INDEX-EE.
     IF CDM-INPUT-INDEX-EE > CDM-INPUT-USED-EE
         GO TO BREAK-EE.
```

LIBRARY NAME - COBOL

MACRO NAME - INSVAL2

PARAMETERS - EE

```
*
*    END OF INSERT LOOP, FROM COMMAND VALUES
*
 END-NDML-EE.
     GO TO LOOP-EE.
 BREAK-EE.
```

```
LIBRARY NAME - COBOL

MACRO NAME - RITCHK

PARAMETERS - OP
             SIGN
             EE
          ECODE


*
*    CHECK RESULTS OF REFERENTIAL INTEGRITY TEST:
*
      IF NDML-COUNT OP SIGN 0
         MOVE "ECODE" TO NDML-STATUS
      GO TO END-NDML-EE.
```

LIBRARY NAME - COBOL

MACRO NAME - UAPESWS

PARAMETERS - EE

```
01    CDM-CS-RESULTS-FILE-EE             PIC X(80).
01    CDM-INPUT-NAME-EE                  PIC X(80).
01    CDM-CS-RESULTS-EE                  PIC X(80).
01    FCB-CDM-RESULTS-EE                 PIC S9(9) COMP.
01    FCB-INPUT-EE                       PIC S9(9) COMP.
01    CDM-INPUT-RETURN-LENGTH-EE         PIC S9(9) COMP.
01    CDM-INPUT-RECORD-LENGTH-EE         PIC S9(9) COMP.
```

LIBRARY NAME - COBOL

MACRO NAME - UAPWS

PARAMETERS - none

```
*
*    ITEMS FOR EACH NDML REQUEST
*
 01   CDM-NO-SUBTRANS            PIC 999.
 01   CDM-DRS-ACTION             PIC X.
 01   CDM-PTR                    PIC 9(5).
 01   NDML-COUNT                 PIC 9(6).
 01   NDML-STATUS                PIC X(5).
      88 OK            VALUE "00000".
 01   CDM-CE-FLAG                PIC 9.
 01   CDM-CE-EOF-FLAG            PIC 9.
      88  CDM-CE-EOF             VALUE 1.
 01   CDM-FLAG-ARRAY.
      03   FLAG-X OCCURS 25 TIMES     PIC 9.
 01  NDML-CS-COUNT               PIC 9(6).
 01  NDML-RFT-COUNT              PIC 9(6).
 COPY ERRFS OF IISSCLIB.
 01  DISPOSITION                 PIC X.
 01  NUMBER-OF-RECORDS   PIC S9(9) COMP  VALUE 2000.
```

```
LIBRARY NAME - COBOL

MACRO NAME - UAPWSI

PARAMETERS - P1
             EE

*
*    TABLE TO STORE INSERT VALUES
*
*     FOUND IN NDML COMMAND
 01   CDM-INPUT-INDEX-EE       PIC 999 VALUE 0.
 01   CDM-INPUT-USED-EE        PIC 999 VALUE P1.
 01   CDM-INPUT-EE.
      02  CDM-INPUT-ENTRY OCCCURS P1 TIMES.
```

```
LIBRARY NAME - COBOL

MACRO NAME - CCCALL

PARAMETERS - P1
             P2
             P3
*
*    CALL CS SELECTOR
*
     CALL "P1" USING
            CDM-CS-RESULTS-FILE-P2
            NDML-COUNT
            CDM-CSQ-TABLE-P3
*
            CDM-CS-RESULTS-P3
            CDM-CS-COUNT-P3
            NDML-STATUS
```

```
LIBRARY NAME - COBOL

MACRO NAME - CS2CALL

PARAMETERS P1
           P2
           P3

     IF NDML-COUNT > 0
         CALL "P1" USING
                CDM-CS-RESULTS-FILE-P2
                CDM-CSQ-TABLE-P3
                NDML-COUNT
                NDML-STATUS
     IF NOT OK
         GO TO END-NDML-P2.
```

LIBRARY NAME - FORTRAN

MACRO NAME - CCCALL

```
PARAMETERS - P1
             P2
             P3
               P4
               P5

       CALL P1 ( %REF(P2), %REF(NDMLCT), %REF(P3)
      *         , %REF(P4), %REF(P5), %REF(NDMLST))
```

LIBRARY NAME - FORTRAN

MARCO NAME - CECALL

```
PARAMETERS - P1
             MMMMM
             P2
               P3
               P4
```

```
       CEFLAG  =  P1
       CALL MMMMM( %REF(CEFLAG), %REF(P2), %REF(P3)
      *          , %REF(FLAGAR), %REF(P4), %REF(EOFFLA)
      *          , %REF(NDMLST))
```

```
LIBRARY NAME - FORTRAN

MACRO NAME - CS2CALL

PARAMETERS - P1
             P2
             P3
               P4

       IF (CHARCT .NE. '000000') THEN
          CALL P1( %REF(P3), %REF(P4), %REF(CHARCT)
      *           , %REF(NDMLST))
          IF (NDMLST .NE. '00000' ) GO TO 93P2
       ENDIF
```

LIBRARY NAME - FORTRAN

MACRO NAME - DRSCALL

```
PARAMETERS - P1
             P2
             P3
             P4
             P5
             P6
             P7
             P8
```

```
       NOSSUB   =   P1
       DRSACT   =   'P2'
       CALL CDS01( %REF(NOSSUB), %REF(DRSACT), %REF(P3)
     *           , %REF(P4), %REF(P5)
     *           , %REF(P6)
     *           , %REF(P7), %REF(P8), %REF(CHARCT)
     *           , %REF(NDMLST))
```

LIBRARY NAME - FORTRAN

MACRO NAME - ENDLOOP

PARAMETERS - EE

```
        IF (EDFFLA .NE. '1') GO TO 94EE
91EE    CONTINUE
93EE    CONTINUE
```

LIBRARY NAME - FORTRAN

MACRO NAME - ERRCHK

PARAMETERS - EE

```
       IF (NDMLST .NE. '00000') GO TO 93EE
```

LIBRARY NAME - FORTRAN

MACRO NAME - ERRCHKCE

PARAMETERS - EE

```
       IF (NDMLST .NE. '00000' .OR.
      *    EOFFLA .EQ. '1') GO TO 93EE
```

```
LIRARY NAME - FORTRAN

MACRO NAME - FILSAV1

PARAMETERS - EE
               F1
               P1
               P2
               P3

     IF (EOFFLA .EQ. '1') GO TO 93EE
     FILEST = 'W'
     P1 = F1
     CALL OPNFIL ( %REF(P2), %REF(NDMLST), %REF(P1)
*                  , %REF(FILEST), %REF(P3), %REF(NUMREC))
     IF (NDMLST .NE. '00000') GO TO 93EE
94EE CONTINUE
```

LIBRARY NAME - FORTRAN

MACRO NAME - FILSAV2

PARAMETERS - EE
P1

```
       IF (EOFFLA .NE. '1') GO TO 94EE
       FILEST  =  'K'
       CALL CLSFIL ( %REF(P1), %REF(NDMLST), %REF(FILEST))
       IF (NDMLST .NE. '00000') GO TO 93EE
93EE   CONTINUE
```

LIBRARY NAME - FORTRAN

MACRO NAME - INSFIL1

```
PARAMETERS - EE
             F1
               P1
               P2
               P3
               P5
               P6

       FILEST  =  'R'
       P1      =  F1
       CALL OPNFIL ( %REF(P2), %REF(NDMLST), %REF(P1),
      *              %REF(FILEST), %REF(P3),
      *              %REF(NUMREC))
       IF (NDMLST .NE. '00000') GO TO 91EE
94EE   CONTINUE
       CALL INPFIL ( %REF(P2), %REF(NDMLST), %REF(P5),
      *              %REF(P3), %REF(P6))
       IF (NDMLST .NE. '00000') GO TO 91EE
```

LIBRARY NAME - FORTRAN

MACRO NAME - INSFIL2

PARAMETERS - EE
             P1

```
93EE    CONTINUE
        GO TO 94EE
91EE    CONTINUE
        FILEST  =  'K'
        CALL CLSFIL( %REF(P1), %REF(NDMLST), %REF(FILEST))
```

LIBRARY NAME - FORTRAN

MACRO NAME - INSVAL1

```
PARAMETERS - EE
               P1
               P2

       P1   =  0
94EE   CONTINUE
       P1   =  P1   +  1
       IF (P1 .GT. P2) GO TO 91EE
```

LIBRARY NAME - FORTRAN

MACRO NAME - INSVAL2

PARAMETERS - EE

```
93EE   CONTINUE
       GO TO 94EE
91EE   CONTINUE
```

```
LIBRARY NAME - FORTRAN

MACRO NAME - RITCHK

PARAMETERS - OP
             SIGN
             EE
             ECODE

       IF (CHARCT OP SIGN '000000') THEN
           NDMLST  =  'ECODE'
           GO TO 93EE
       END IF
```

LIBRARY NAME - FORTRAN

MACRO NAME - UAPESWS

```
PARAMETERS - P1
             P2
             P3
             P4
             P5
             P6
             P7

       CHARACTER*80 P1
       CHARACTER*80 P2
       CHARACTER*80 P3
       INTEGER      P4
       INTEGER      P5
       INTEGER      P6
       INTEGER      P7
```

LIBRARY NAME - FORTRAN

MACRO NAME - UAPWS

PARAMETERS - NONE

```
       CHARACTER*3  NOSSUB
       CHARACTER*1  DRSACT
       CHARACTER*5  PTRCDM
       INTEGER      NDMLCT
       CHARACTER*6  CHARCT
       CHARACTER*5  NDMLST
       CHARACTER*1  CEFLAG
       CHARACTER*1  EOFFLA
       CHARACTER*25 FLAGAR
       INTEGER      RFTCTI
       CHARACTER*3  RFTCTC
       CHARACTER*2  RFTCTJ
       INTEGER      CSCNTI
       CHARACTER*3  CSCNTC
       CHARACTER*1  FILEST
       INTEGER      NUMREC
       DATA            NUMREC /2000/
       REAL         CSUSED
          INTEGER      DECIML
          INTEGER      SIGN
          INTEGER      DIGIT
          INTEGER      ENPOSR
          INTEGER      ENPOSC
          INTEGER      SPOSR
          INTEGER      SPOSC
```

LIBRARY NAME - FORTRAN

MACRO NAME - UAPWSI

```
PARAMETERS - P1
             P2
                          P3

       INTEGER    P2
       INTEGER    P3
       DATA       P3         /P1/
```

SECTION 28

FUNCTION CDP10A - Generate code to transform external schema values to conceptual schema values.

This function will:

1. Generate the transformation of ES values and variables for runtime search parameters and update values to Conceptual Schema format.

2. Generate code to build the pool of values and information for the DRS.

NOTE: If the user's application program is written in FORTRAN, then as of release 2.3, all FORTRAN variable names will be generated with a length of six. This will be done by generating names of the convention: CDMXXX where XXX is any combination of three characters. The three character combination is determined by routine CDCREFO. This routine associates a six character FORTRAN variable with the corresponding COBOL variable. This association between the COBOL name and the generated FORTRAN name is stored in the FORTRAN-VARIABLE-TABLE. The FORTRAN-VARIABLE-TABLE is copied into modified user's application program. In this design specification, the COBOL name will be used to show how the FORTRAN code will be generated.

28.1 Inputs

1. Source Language Indicator of the Application Program

   LANG-NC

2. Application Program parcel names

   FD-FILE-NAME
   WORK-FILE-NAME
   PROC-FILE-NAME

3. Conceptual Schema representation of the data

   CS-ACTION-LIST
   CS-QUALIFY-LIST

4. External Schema representation of the data

   ES-ACTION-LIST
   ES-QUALIFY-LIST

5. Internal Schema representation of the data

   IS-ACTION-LIST
   IS-QUALIFY-LIST

6. User View Abbreviation List

   UV-ABBR-LIST

7. Code generation table

   CODE-GENERATOR-TABLE

8. Subtransaction Identification table for the NDML request

   SUBTRANS-PROCESS-ID-TABLE

9. Next Parameter Number for complex mapping calls

   NEXT-PARAMETER-NO

10. Application Program error file name

   ERROR-FILE

11. Logical Unit Work Name

   LUW

12. Fortran Variable Association Table

   FORTRAN-VARIABLE-TABLE

13. Target Host Name

   TARGET-HOST

28.2 CDM Requirements

None

28.3 Internal Requirements

None

28.4 Processing

1. Generate External/Conceptual Schema data definitions for runtime update/search values. Call function "CDECWS" with the following parameters:

LANG-NO
WORK-FILE-NAME
CS-ACTION-LIST
CS-QUALIFY-LIST
ES-ACTION-LIST
ES-QUALIFY-LIST
FORTRAN-VARIABLE-TABLE
RET-STATUS

2. Generate "MOVE" statements from user defined variables or constants to External Schema variables for update/search values. Call function "CDUEMV" with the following parameters if it is not the case that CS-ACTION = "I" or "K" or CS-ACTION = "1" and ES-ACTION = "I":

LANG-NO
PROC-FILE-NAME
CS-ACTION-LIST
CS-QUALIFY-LIST
ES-ACTION-LIST
ES-QUALIFY-LIST
FORTRAN-VARIABLE-TABLE
RET-STATUS

3. Perform steps 3.1 through 3.4 for each subtransaction. This will perform logic to calculate the length of the pool.

3.1 Initialize local variables

Set SUB-POOL-LEN to ZERO
Set WS-DBID to STR-DBID(SUB-INDEX).
Set TEMP-SUB-INDEX to SUB-INDEX

3.2 Perform steps 3.2.1 through 3.2.2 for each entry in the IS-QUALIFY-LIST if CS-ACTION not equal "I".

3.2.1 If ISQ-CSQ-PTR equals zero and ISQ-TYPE equals 2, continue at step 3.2.

3.2.2 If ISQ-TYPE equals 2, ISQ-DBIDL equals WS-DBID, ISQ-SUBTRANS-IDL equals TEMP-SUB-INDEX, and ISQ-OP is not equal "NN" or "NL" then:

Set CSQ-INDEX to ISQ-CSQ-PTR.
Set SUB-POOL-LEN equal to SUB-POOL-LEN plus CSQ-L-SIZE.

3.3 Peform step 3.3.1 for each entry in the IS-ACTION-LIST if IS-ACTION equals "I" or "M".

```
            3.3.1  If IS-DBID equals WS-DBID, IS-SUTRANS-ID
                   equals TEMP-SUB-INDEX, IS-MAPPED-TO,
                   IS-USER, IS-CS-PTR is greater than zero,
                   and IS-SOURCE is not equal "G", then:

                   Set CS-INDEX to IS-CS-PTR.
                   Set SUB-POOL-LEN equal to SUB-POOL-LEN
                       plus CS-SIZE.

       3.4  Set SUB-POOL-LEN equal to SUB-POOL-LEN
            plus FIXED-LEN.
            Set TOTAL-POOL-LEN equal to TOTAL-POOL-LEN
            plus SUB-POOL-LEN.

4.  Generate code to define the pool.

       If the language is COBOL, call "CDMACR" utility with
       the following:

                     Library Name - COBOL
                     Macro Name   - WSPOOL
                     Parameters
                       EE = ES-NDML-NO
                       P1 = CS-NDML-NO
                       P5 = TOTAL-POOL-LEN

       Else, if FORTRAN, generate:
                     CHARACTER*tt  CDM-POOL-ee-cc
                             where tt = TOTAL-POOL-LEN
                                      ee = ES-NDML-NO
                                      cl = CS-NDML-NO

5.  Perform steps 5.1 through 5.10 for each subtransaction.

       5.1  Initialize local variables.

                     Set SUB-POOL-LEN to ZERO.
                     Set WS-DBID to STR-DBID(SUB-INDEX).
                     Set TEMP-SUB-INDEX to SUB-INDEX.

       5.2  Perform steps 5.2.1 through 5.2.2 for each entry
            in the IS-QUALIFY-LIST if CS-ACTION NOT = "I".

            5.2.1  If ISQ-CSQ-PTR equals zero and ISQ-TYPE
                   equals 2, continue at step 5.2.

            5.2.2  If ISQ-TYPE equals 2, ISQ-DBIDL equals
                   WS-DBID, ISQ-SUBTRANS-IDL equals
                   TEMP-SUB-INDEX, and ISQ-OP is not equal
                   "NN" or "NL" then perform steps 5.2.2.1
                   through 5.2.2.10.

                 5.2.2.1  Set CSQ-INDEX and CLIST-INDEX to
                          ISQ-CSQ-PTR

                 5.2.2.2  If SOURCE-IS-VIEW, set
                          SUB-POOL-LEN equal to
                          SUB-POOL-LEN plus CSQ-L-SIZE.
```

Continue at step 5.2.

5.2.2.3 Set ELIST-INDEX to CSQ-ES-PTR

5.2.2.4 If CS-ACTION equals "K" or "1", scan the CS-ACTION-LIST searching for CSQ-AUCL equal to CS-AUC. When found, perform step 5.2.2.4.1.

5.2.2.4.1 Set DI-NO to ES-DI-NO
Set SEC-NO to ES-UV-NO

5.2.2.5 If CS-ACTION is not equal "K" or "1", perform step 5.2.2.5.1.

5.2.2.5.1 Set ESQ-INDEX to CSQ-ES-PTR
Set DI-NO to ESQ-L-DI-NO
Set SEC-NO to ESQ-L-UV-NO
Set AUC-NO to CSQ-AUCL

5.2.2.6 Scan the UV-ABBR-LIST, searching for UV-NO equal SEC-NO. When found, set ENTRY-STATUS to 1 and SEC-ID to UV-NAME. If not found, perform proper error handling.

5.2.2.7 If ES-FILE-NAME not equal spaces or ES-STRUCTURE not equal spaces,
set FILE-STRUC-VAR-FLAG equal "F"
else set FILE-STRUC-VAR-FLAG equal "V".

5.2.2.8 Generate code required for the transformation of retrieved/qualified datafields from external schema format to conceptual schema format. Call function CDEC with the following parameters:

LANG-NO
WORK-FILE-NAME
PROC-FILE-NAME
NEXT-PARAMETER-NO
CLIST-INDEX
ELIST-INDEX
ACTION-TYPE
ES-ACTION
ES-NDML-NO
CS-NDML-NO
DI-NO
AUC-NO
FILE-STRUC-VAR-FLAG

FORTRAN-VARIABLE-TABLE
TARGET-HOST
RET-STATUS

5.2.2.9 Add CSQ-L-SIZE to SUB-POOL-LEN

5.2.2.10 Continue at step 5.2.

5.3 Perform steps 5.3.1 through 5.3.2 for each entry in the IS-ACTION-LIST if CS-ACTION equals "I" or "M".

5.3.1 If CS-ACTION equals "I"
Set ACTION-TYPE equal "I"
else set ACTION-TYPE equal "U".

5.3.2 If IS-DBID equals WS-DBID, the entry is not generated, the entry is mapped to, IS-SUBTRANS-ID equals TEMP-SUB-INDEX, the entry is mapped to and IS-CS-PTR is greater than zero, perform steps 5.3.2.1 through 5.3.2.6.

5.3.2.1 Set CLIST-INDEX equal IS-CS-PTR.
Set CS-INDEX equal IS-CS-PTR.
Set ES-INDEX equal CS-ES-PTR.
Set ELIST-INDEX equal CS-ES-PTR.
Set DI-NO equal ES-DI-NO.
Set SEC-NO equal ES-UV-NO.
Set AUC-NO equal CS-AUC.

5.3.2.2 Scan the UV-ABBR-LIST, searching for UV-NO equal SEC-NO. When found, set ENTRY-STATUS to 1 and SEC-ID to UV-NAME. If not found, perform proper error handling.

5.3.2.3 If ES-FILE-NAME not equal spaces or ES-STRUCTURE not equal spaces,
set FILE-STRUC-VAR-FLAG equal "F"
else set FILE-STRUC-VAR-FLAG equal "V".

5.3.2.4 Generate code required for the transformation of retrieved/qualified datafields from external schema format to conceptual schema format. Call function CDEC with the following parameters:

LANG-NO
WORK-FILE-NAME
PROC-FILE-NAME
NEXT-PARAMETER-NO
CLIST-INDEX

ELIST-INDEX
ACTION-TYPE
ES-ACTION
ES-NDML-NO
CS-NDML-NO
DI-NO
AUC-NO
FILE-STRUC-VAR-FLAG
FORTRAN-VARIABLE-TABLE
TARGET-HOST
RET-STATUS

5.3.2.5 Add CS-SIZE to SUB-POOL-LEN.

5.3.2.6 Continue at step 5.3.

5.4 Add FIXED-LEN to SUB-POOL-LEN.

5.5 Scan the CODE-GENERATOR-TABLE searching for CGT-DBID equal WS-DBID and the CGT-MOD-TYPE is RP-MAIN. Perform steps 5.5.1 through 5.5.2.

5.5.1 If the entry is found
Set RP-DRIVER-NAME to CGT-MOD-NAME.
Set REMOTE-LOCAL to CGT-LOCALITY.
Set ENTRY-STATUS to 1.

5.5.2 If the entry is not found, perform steps 5.5.2.1 through 5.5.2.4.

5.5.2.1 Call function CDF1RP with parameters:

LUW
WS-DBID
TEMP-MOD-NAME
REMOTE-LOCAL
FOUND-FLAG
CODE-GENERATOR-TABLE
RET-STATUS

5.5.2.2 If entry not found, perform proper error handling.

5.5.2.3 If entry found and is local, set RP-MAIN-DIR and RP-MAIN-END to spaces. Set RP-MAIN-NAME to TEMP-MOD-NAME.

5.5.2.4 If entry found and is remote, Set RP-DRIVER-NAME to TEMP-MOD-NAME.

5.6 If language is COBOL, perform steps 5.6.1 through 5.6.2.

5.6.1 Scan the CODE-GENERATOR-TABLE searching for CGT-CASE-NO equal CS-NDML-NO, CGT-SUBTRANS-ID equal TEMP-SUB-INDEX, and CGT-MOD-TYPE is RP-SUB. When found, set RP-SUB-NAME to CGT-MOD-NAME.

5.6.2 Generate:

```
STRING "aabbccdd"

where aa = SUB-POOL-LEN
      bb = RP-SUB-NAME
      cc = RP-DRIVER-NAME
      dd = REMOTE-LOCAL
```

5.7 If language is FORTRAN, perform steps 5.7.1 through 5.7.10.

5.7.1 Calculate END-POS equal START-POS + 3 - 1

5.7.2 Generate:

```
CDM-POOL-eee-ccc(ss:pp) = 'll'

       where eee = ES-NDML-NO
             ccc = CS-NDML-NO
             ss  = START-POS
             pp  = END-POS
             ll  = SUB-POOL-LEN
```

5.7.3 Calculate START-POS equal END-POS + 1.
Calculate END-POS equal START-POS + 6 - 1.

5.7.4 Scan the CODE-GENERATOR-TABLE searching for CGT-CASE-NO equal CS-NDML-NO, CGT-SUBTRANS-ID equal TEMP-SUB-INDEX, and CGT-MOD-TYPE is RP-SUB. When found, set RP-SUB-NAME to CGT-MOD-NAME.

5.7.5 Generate:

```
CDM-POOL-eee-ccc(ss:pp) = 'rr'

where eee = ES-NDML-NO
      ccc = CS-NDML-NO
      ss  = START-POS
      pp  = END-POS
      rr  = RP-SUB-NAME
```

5.7.6 Calculate START-POS equal END-POS + 1.
Calculate END-POS equal START-POS + 10 - 1.

5.7.7 Generate:

```
CDM-POOL-eee-ccc(ss:pp) = 'dd'
```

```
where eee = ES-NDML-NO
      ccc = CS-NDML-NO
      ss  = START-POS
      pp  = END-POS
      dd  = RP-DRIVER-NAME
```

5.7.8 Calculate START-POS equal END-POS + 1. Calculate END-POS equal START-POS + 1 - 1.

5.7.9 Generate:

```
CDM-POOL-eee-ccc(ss:pp) = 'mm'

where eee = ES-NDML-NO
      ccc = CS-NDML-NO
      ss  = START-POS
      pp  = END-POS
      mm  = REMOTE-LOCAL
```

5.7.10 Calculate START-POS equal END-POS + 1.

5.8 Perform steps 5.8.1 through 5.8.2 for each entry in the IS-QUALIFY-LIST if CS-ACTION not equal "I".

5.8.1 If ISQ-CSQ-PTR equals zero and ISQ-TYPE equals 2:

Continue at step 5.8.

5.8.2 If ISQ-TYPE equals 2, ISQ-DBIDL equals WS-DBID, ISQ-SUBTRANS-IDL equals TEMP-SUB-INDEX, and ISQ-OP is not equal "NN" or "NL", then perform steps 5.8.2.1 through 5.8.2.4.

5.8.2.1 Set CSQ-INDEX and CLIST-INDEX to ISQ-CSQ-PTR.

5.8.2.2 If language is COBOL, generate:

```
CSQ-VAR-ccc-ii

where ccc = CS-NDML-NO
      ii  = CLIST-INDEX
```

5.8.2.3 If language is FORTRAN, perform steps 5.8.2.3.1 through 5.8.2.3.3.

5.8.2.3.1 Calculate END-POS equal START-POS + CSQ-L-SIZE - 1

5.8.2.3.2 If CSQ-L-TYPE not equal "C", generate:

```
                    DECIML = nn
                    CALL RELFTN(DECIML,
                    CSQ-VAR-ccc-ii,
                    XHQcccii,
                    CSQ-LONG-VAR-cccii
                    CDM-POOL-eee-ccc(ss:pp) =
                    XHQcccii

               else generate:

                    CDM-POOL-eee-ccc(ss:pp) =
                        CSQ-VAR-ccc-ii

                    where eee = ES-NDML-NO
                          ccc = CS-NDML-NO
                          nn  = CSQ-L-ND
                          ii  = CLIST-INDEX
                          ss  = START-POS
                          ee  = END-POS
```

5.8.2.3.3 Calculate START-POS equal END-POS + 1.

5.8.2.3.4 Sum the CSQ-L-SIZE's of all CSQ-ENTRYS before the one currently pointed to by CSQ-INDEX, where CSQ-R-SIZE equals zero, and put the total in START-POSC.

5.8.2.3.5 Add 1 to START-POSC.
Set END-POSC equal to START-POSC plus CSQ-L-SIZE minus 1.

5.8.2.3.6 If CSQ-L-TYPE equals "C", generate:

```
CDM-POOL-eee-ccc(sp:pp) =
CSQ-VAR-ccc-ii
Else, generate:
   CDM-POOL-eee-ccc(ss:pp) =
   XHQcccii
where  eee = ES-NDML-NO
       ccc = CS-NDML-NO
       ss  = START-POSC
       pp  = END-POSC
       ii  = CLIST-INDEX
```

5.8.2.4 Continue at step 4.8.

5.9 Perform steps 5.9.1 through 5.9.1.4. for each entry in the IS-ACTION-LIST if CS-ACTION equals "I" or "M".

5.9.1 If IS-DBID equals WS-DBID, the entry is not generated, the entry is mapped to, IS-SUBTRANS-ID equals TEMP-SUB-INDEX, and IS-CS-PTR is greater than zero, perform steps 5.9.1.1 through 5.9.1.4.

```
        5.9.1.1  Set CS-INDEX and CLIST-INDEX to
                 IS-CS-PTR.

        5.9.1.2  If language is COBOL, generate:

                 CS-VAR-ccc-ii

                 where ccc = CS-NDML-NO
                       ii  = CLIST-INDEX

        5.9.1.3  If language is FORTRAN, perform
                 steps 5.9.1.3.1 through
                 5.9.1.3.3.

        5.9.1.3.1  Calculate END-POS =
                   START-POS + CS-SIZE - 1

        5.9.1.3.2  If CS-TYPE is not equal to "C",
                   generate:

                        DECIML = nn
                        CALL RELFTN(DECIML,
                             CS-VAR-cccii, XHScccii,
                             CS-LONG-VAR-ccc-ii)
                        CDM-POOL-eee-ccc(ss:pp) =
                             XHScccii

                   else generate:

                        CDM-POOL-eee-ccc(ss:pp) =
                            CS-VAR-ccc-ii

                   where eee = ES-NDML-NO
                         ccc = CS-NDML-NO
                         nn  = CS-ND
                         ii  = CLIST-INDEX
                         ss  = START-POS
                         ee  = END-POS

        5.9.1.3.3  Calculate START-POS =
                   END-POS + 1

        5.9.1.4  Continue at step 5.9.

   5.10 If language is COBOL, generate:

        DELIMITED BY SIZE INTO
        CDM-POOL-eee-ccc WITH POINTER CDM-PTR.

        where eee = ES-NDML-NO
          ccc = CS-NDML-NO

6.  Terminate processing of function PRE10A.

   6.1  Close the two parcels of the user's application
        program.
```

6.2 Set the function status variable and exit processing.

28.5 Outputs

1. Error status of the function

   RET-STATUS

2. Code generated into the parcels of the Application Program

LIBRARY NAME - COBOL

MACRO NAME - WSPOOL

PARAMETERS - P1
             P5
             EE

```
*
*    POOL OF INPUT PARAMETERS FOR DRS TO PASS ON TO RP:
*
 01  CDM-POOL-EE-P1              PIC X(P5).
```

SECTION 29

FUNCTION CDP10B Generate precompiler tables into the users Application Program.

This function will:

1. Generate the transfer of precompiler tables into the users Application Program. These tables include:

   JQG - Join Query Graph
   APL - Attribute Pair List
   RFT - Result Field Table
   CSAL - Conceptual Schema Action List

NOTE: If the user's application program is written in FORTRAN, then as of release 2.3, all FORTRAN variable names will be generated with a length of six. This will be done by generating names of the convention: CDMXXX where XXX is any combination of three characters. The three character combination is determined by routine CDCREFO. This routine associates a six character FORTRAN variable with the corresponding COBOL variable. This association between the COBOL name and the generated FORTRAN name is stored in the FORTRAN-VARIABLE-TABLE. The FORTRAN-VARIABLE-TABLE is copied into modified user's application program. In this design specification, the COBOL name will be used to show how the FORTRAN code will be generated.

29.1 Inputs

1. Source Language Indicator of the Application Program

   LANG-NO

2. Application Program parcel names

   WORKFILE-NAME
   PROCFILE-NAME

3. External Schema representation of the data

   ES-NDML-NO

4. Join Query Graph for the NDML request

   JQG
   JQG-ATTRIBUTE-PAIR-LIST

5. Result Field Table

   RFT

6. Conceptual Schema representation of the data

   CS-ACTION-LIST

7. Fortran Variable Association Table

   FORRAN-VARIABLE-TABLE

8. Target Host Name

   TARGET-HOST

29.2 CDM Requirements

None

29.3 Internal Requirements

None

29.4 Processing

1. If CS-ACTION is BEGIN, CDMMIT, or ROLLBACK, generate a variable into the WS parcel to hold the pool.

   1.1 If language is COBOL, generate:

```
01 CDM-POOL-ee-cc PIC X.

         where ee = ES-NDML-NO
               cc = CS-NDML-NO
```

   1.2 If language is FORTRAN, generate:

```
CHARACTER*1  CDM-POOL-eee-cc

        where ee = ES-NDML-NO
              cc = CS-NDML-NO
```

2. Generate working storage variables to hold the precompiler tables required for runtime execution of the NDML request. The tables required are:

   JQG
   APL
   RFT
   CSAL

   If language is COBOL, perform steps 2.1 and 2.2. If language is FORTRAN, perform step 2.3.

   2.1 For each non-empty table (USED > 0), generate a "COPY" statement to include the copy member using the "CDMACR" utility.

TABLE	MACRO
JQG	UAPWS2
APL	UAPWS4
RFT	UAPWS3
CSAL	UAPWS1

2.2 For each empty table, generate the following data definition.

```
                TABLE

JQG    01 CDM-JQG-ee-cc    PIC 9999   VALUE 0.
APL    01 CDM-APL-ee-cc    PIC 9999   VALUE 0.
RFT    01 CDM-RFT-ee-cc    PIC 9999   VALUE 0.
CSAL   01 CDM-CSAL-ee-cc   PIC 9999   VALUE 0.

                where
                ee = ES-NDML-NO
                cc = CS-NDML-NO
```

2.3 For each non-empty table (USED > 0), generate a variable to hold the copy member.

2.3.1 If CS-USED is greater than zero calculate TEMP-NO = CS-ENTRY * CS-USED + CS-HEAD

```
Generate:
   CHARACTER*nn  CDM-CSAL-ee-cc
   DATA          CDM-CSAL-ee-cc  /'uu'/

If CS-USED is equal zero, generate
   CHARACTER*4   CDM-CSAL-ee-cc
   DATA          CDM-CSAL-ee-cc
/'0000'/

where ee = ES-NDML-NO
      cc = CS-NDML-NO
      nn = TEMP-NO
      uu = CS-USED
```

2.3.2 If JQG-USED is greater than zero calculate TEMP-NO = JQG-ENTRY * JQG-USED + JQG-HEAD

```
Generate:
   CHARACTER*nn  CDM-JQG-ee-cc
   DATA          CDM-JQG-ee-cc  /'uu'/

If JQG-USED is equal zero, generate
   CHARACTER*4   CDM-JQG-ee-cc
   DATA          CDM-JQG-ee-cc  /'0000'/

where ee = ES-NDML-NO
      cc = CS-NDML-NO
      nn = TEMP-NO
      uu = JQG-USED
```

2.3.3 If APL-USED is greater than zero calculate TEMP-NO = APL-ENTRY * APL-USED + APL-HEAD

```
Generate:
   CHARACTER*nn  CDM-APL-ee-cc
   DATA          CDM-APL-ee-cc
/'uu0022'/

If APL-USED is zero, generate:
   CHARACTER*4   CDM-APL-ee-cc
   DATA          CDM-APL-ee-cc  /'0000'/

where ee = ES-NDML-NO
      cc = CS-NDML-NO
      nn = TEMP-NO
       uu = APL-USED
```

2.3.4 If RFT-USED is greater than zero calculate TEMP-NO = RFT-NO * RFT-USED + RFT-HEAD

```
Generate:
   CHARACTER*nn  CDM-RFT-ee-cc
   DATA          CDM-RFT-ee-cc
/'uu000024'/

If RFT-USED is zero, generate
   CHARACTER*6   CDM-RFT-ee-cc
   DATA          CDM-RFT-ee-cc
/'000000'/

where ee = ES-NDML-NO
      cc = CS-NDML-NO
      nn = TEMP-NO
      uu = RFT-USED
```

3. Generate code to populate the tables with precompiled results required for runtime execution of the NDML request.

   3.1 For each non-empty table (USED > 0) generate MOVE statements to move the non-repeating data of each table and each used entry of the table to the newly defined variables.

29.5 Outputs

1. Error status of the function

   RET-STATUS

2. Code generated into the parcels of the Application Program

LIBRARY NAME - COBOL

MACRO NAME - UAPWS1

PARAMETERS - EE
             CC
             P1

```
*
 COPY CSAL OF IISSCLIB REPLACING
   ==CS-ACTION-LIST== BY
   ==CDM-CSAL-EE-CC==
   ==50== BY ==P1==.
```

LIBRARY NAME - COBOL

MACRO NAME - UAPWS2

PARAMETERS - EE
CC
P2

```
 COPY JQGTBL OF IISSCLIB REPLACING
   ==01  JQG==  BY
   ==01  CDM-JQG-EE-CC==
   ==30==  BY ==P2==.
```

LIBRARY NAME - COBOL

MACRO NAME - UAPWS3

PARAMETERS - EE
             CC
             P4

```
 COPY RFTABLE OF IISSCLIB REPLACING
   ==01  RFT== BY
   ==01  CDM-RFT-EE-CC==
   ==200==   BY ==P4==.
```

LIBRARY NAME - COBOL

MACRO NAME - UAPWS4

```
PARAMETERS - EE
             CC
             P3
```

```
 COPY APL OF IISSCLIB REPLACING
  ==JQG-ATTRIBUTE-PAIR-LIST== BY
  ==CDM-APL-EE-CC==
  ==60== BY ==P3==.
```

SECTION 30

FUNCTION CDP10C - Generate External Schema Results into User Variables or Structures

This function will:

1. Generate code to transfer the External Schema results record into user specified variables or user specified structure.

   NOTE: If the user's application program is written in FORTRAN, then as of release 2.3, all FORTRAN variable names will be generated with a length of six. This will be done by generating names of the convention: CDMXXX where XXX is any combination of three characters. The three character combination is determined by routine CDCREFO. This routine associates a six character FORTRAN variable with the corresponding COBOL variable. This association between the COBOL name and the generated FORTRAN name is stored in the FORTRAN-VARIABLE-TABLE. The FORTRAN-VARIABLE-TABLE is copied into modified user's application program. In this design specification, the COBOL name will be used to show how the FORTRAN code will be generated.

30.1 Inputs

1. Source Language Indicator of the Application Program

   LANG-NO

2. Application Program parcel names

   PROC-FILE-NAME

3. External Schema representation of the data

   ES-ACTION-LIST

4. Conceptual Schema representation of the data

   CS-NDML-NO

5. Fortran Variable Association Table

   FORTRAN-VARIABLE-TABLE

30.2 CDM Requirements

None

30.3 Internal Requirements

None

30.4 Processing

1. Generate code to transfer the results of the NDML query into user specified variables or a user specified structure.

   1.1 If results are to be placed in a user structure (ES-STRUCTURE NOT = SPACE) continue at step 1.2. If results are not to be placed into a file (ES-FILE-NAME = SPACES) continue.

   For each ES field projected generate a move of the results to the user specified variable. Set VARIABLE-NAME to ES-LOCAL-VARIABLE (ES-INDEX, 1). If language is FORTRAN, perform step 1.1.2, else perform step 1.1.1.

   1.1.1 Generate:

```
                MOVE ES-RES-ccc-nn TO vv

        where

                ccc = CS-NDML-NO
                nn  = ES-INDEX
                vv  = VARIABLE-NAME
```

   Exit processing.

   1.1.2 If the function chosen for the entry is COUNT, MEAN, AVG, or SUM or ES-TYPE is not equal to "C", continue at step 1.1.2.1, else continue at step 1.1.2.5.

   1.1.2.1 If the function chosen for the entry is COUNT, perform steps 1.1.2.1.1 through 1.1.2.1.

   1.1.2.1.1 Calculate END-POS equals START-POS plus 8.

   1.1.2.1.2 Generate:

```
               Call
CONDIG(CDM-RESULTS-ee(ss:pp),
SIGN, DIGIT, NDMLST)
               Call
CHRINT(CDM-RESULTS-ee(ss:pp)
               *    vv, NDMLST)
                 vv =
               * vv*SIGN
               where  ee =
ES-NDML-NO
```

```
                                          ss =
START-POS
                                      pp =
END-POS
                                      vv =
VARIABLE-NAME

       1.1.2.1.3  Calculate
START-POS equals END-POS plus 1.

1.1.2.2  If the function chosen for the
         entry is MEAN, SUM, or AVG, or
         ES-TYPE is F, perform steps
         1.1.2.2.1 through 1.1.2.2.2.

       1.1.2.2.1  Generate:
                                     vv =
ES-RES-cc-nn
                               where vv =
VARIABLE-NAME
                                     cc =
CS-NDML-NO
                                        nn =
ES-INDEX

       1.1.2.2.2  Calculate
START-POS equals START-POS plus
8.

1.1.2.3  If ES-TYPE is "I", perform steps
         1.1.2.3.1 through 1.1.2.3.2.

1.1.2.3.1  Generate:
                vv = ES-RES-cc-nn
                where vv = VARIABLE-NAME
                cc = CS-NDML-NO
                nn = ES-INDEX

       1.1.2.3.2  If ES-SIZE is
greater than 4,       add 4 to
START-POS.
                               Else add 2 to
START-POS.

1.1.2.4  Continue at step 1.1.2.7.

1.1.2.5  Calculate END-POS = START-POS +
         ES-SIZE - 1.

1.1.2.6  Generate:

         vv = CDM-RESULTS-ee(ss:pp)

   where ee = ES-NDML-NO
         ss = START-POS
         pp = END-POS
         vv = VARIABLE-NAME
```

1.1.2.7 Calculate START-POS = END-POS + 1

1.2 Generate a move of the results to the user specified structure. Generate if COBOL:

```
MOVE CDM-RESULTS-ee TO (es-structure)
```

else generate:

```
(es-structure) = CDM-RESULTS-ee
```

where

ee = ES-NDML-NO

30.5 Outputs

1. Error status of the function

   RET-STATUS

2. Code generated into the parcels of the Application Program

SECTION 31

FUNCTION - CDP10E Process External Schema Insert Value

This function will:

1. Generate External Schema Data

2. Generate definitions for runtime insert values and procedure division code to move the values to temporary defined table.

NOTE: If the user's application program is written in FORTRAN, then as of release 2.3, all FORTRAN variable names will be generated with a length of six. This will be done by generating names of the convention: CDMXXX where XXX is any combination of three characters. The three character combination is determined by routine CDCREFO. This routine associates a six character FORTRAN variable with the corresponding COBOL variable. This association between the COBOL name and the generated FORTRAN name is stored in the *FORTRAN-VARIABLE-TABLE*. The FORTRAN-VARIABLE-TABLE is copied into modified user's application program. In this design specification, the COBOL name will be used to show how the FORTRAN code will be generated.

31.1 Inputs

1. External Schema representation of the data

   ES-ACTION-LIST
   ES-VALUE-USED

2. Application Program parcel names

   ID-FILE-NAME
   FD-FILE-NAME
   WORK-FILE-NAME
   PROC-FILE-NAME

3. Source Language Indicator of the Application Program

   LANG-NO

4. Fortran Variable Association Table

   FORTRAN-VARIABLE-TABLE

31.2 CDM Requirements

None

31.3 Internal Requirements

None

31.4 Processing

1. Perform steps 1.1 through 1.3 if language is COBOL.

   1.1 Generate External Schema Data Definitions for insert values.

   For each entry in the ES-ACTION list generate data definitions into WORKFILE.

```
        03 ES-VAR-INS-eee-nn PIC clause

        where

        eee    = ES-NDML-NO
        nn     = ES-INDEX
        clause = picture clause built by routine
                 "CDPIC" using ES-META-DATA
```

   1.2 Generate procedure division code to populate the temporary table to hold insert values. If ES-VALUE-USED is greater than zero, generate:

```
        MOVE 0 TO CDM-INPUT-INDEX-ee
```

   Generate the following procedure division MOVE statements for each entry in ES-ACTION list, ES-VALUE-USED times.

```
                ADD 1 TO CDM-INPUT-INDEX-ee.

                MOVE {var, value, constant} TO
        ES-VAR-INS-ee-nn(CDM-INPUT-INDEX-ee)

        where

                ee = ES-NDML-NO
                nn = ES-INDEX
```

   1.3 If ES-STRUCTURE not equal spaces, generate:

```
                MOVE ss TO CDM-INPUT-ee.

        where

                ee = ES-NDML-NO
                ss = ES-STRUCTURE
```

2. Perform steps 2.1 through 2.5.2 if language is FORTRAN.

   2.1 Calculate BUFFER-SIZE which is the total of ES-SIZE of all non-deleted ES-ACTION-LIST entries plus one for each non-deleted entry with ES-TYPE equal "F".

   2.2 Generate:

```
CHARACTER*bb   CDM-INPUT-ee

        where bb = BUFFER-SIZE
              ee = ES-NDML-NO
```

   2.3 Perform steps 2.3.1 through 2.3.3 for each entry in the ES-ACTION-LIST.

      2.3.1 If ES-TYPE is equal "C", generate:

```
CHARACTER*ss  ES-VAR-INS-ee-nn(uu)

where ss = ES-SIZE
      ee = ES-NDML-NO
      nn = ES-INDEX

uu = ES-VALUE-USED, if greater than
zero.
```

      Continue at step 2.3.5.

      2.3.2 If ES-TYPE is equal "F", generate:

```
                       DOUBLE PRECISION
ES-VAR-INS-ee-nn(uu)
                       CHARACTER*SS
CHAR-ES-VAR-INS-ee-nn
                          where   ee =
ES-NDML-NO
                                  nn =
ES-INDEX
                                  ss =
ES-SIZE +1
                                  uu =
ES-VALUE-USED, if greater than zero
```

      2.3.3 If ES-TYPE is equal "I", generate

```
INTEGER ES-VAR-INS-ee-nn(uu)
CHARACTER*ss  CHAR-ES-VAR-INS-ee-nn
       where   ee = ES-NDML-NO
               nn = ES-INDEX
               ss = ES-SIZE +1
               uu = ES-VALUE-USED, if
               greater than zero
```

   2.4 If ES-VALUE-USED is greater than zero, generate:

```
CDM-INPUT-INDEX-ee = 0
```

where ee = ES-NDML-NO

2.5 Generate code in the procedure division to populate the temp table to hold insert values from NDML select statement. Perform steps 2.5.1 through 2.5.2 ES-VALUE-USED times.

2.5.1 Generate:

```
CDM-INPUT-INDEX-ee = CDM-INPUT-INDEX-ee
+ 1

   where ee = ES-NDML-NO
```

2.5.2 For each entry in the ES-ACTION-LIST, generate:

```
ES-VAR-INS-ee-nn(CDM-INPUT-INDEX-ee) =
{var, value, constant}

   where ee = ES-NDML-NO
         nn = ES-INDEX
```

Continue at step 2.5.

2.6 If ES-STRUCTURE is not equal spaces, perform steps 2.6.1 through 2.6.3 for each entry in the ES-ACTION-LIST.

2.6.1 Calculate END-POS = START-POS + ES-SIZE - 1

2.6.2 Generate:

```
 ES-VAR-INS-ee-nn = tt(ss:pp)

where ee = ES-NDML-NO
      nn = ES-INDEX
      tt = ES-STRUCTURE
      ss = START-POS
      pp = END-POS
```

2.6.3 Calculate START-POS = END-POS + 1
Continue at step 2.6.

31.5 <u>Outputs</u>

1. Error status of the function

   RET-STATUS

2. Code generated into the parcels of the Application Program

SECTION 32

FUNCTION CDP10F - Generate Data Definitions for Retrieved Results

This function will:

1. Generate program variables to hold the External Schema results of the NDML query.

NOTE: If the user's application program is written in FORTRAN, then as of release 2.3, all FORTRAN variable names will be generated with a length of six. This will be done by generating names of the convention: CDMXXX where XXX is any combination of three characters. The three character combination is determined by routine CDCREFO. This routine associates a six character FORTRAN variable with the corresponding COBOL variable. This association between the COBOL name and the generated FORTRAN name is stored in the FORTRAN-VARIABLE-TABLE. The FORTRAN-VARIABLE-TABLE is copied into modified user's application program. In this design specification, the COBOL name will be used to show how the FORTRAN code will be generated.

32.1 Inputs

1. External Schema representation of the data

   ES-ACTION-LIST

2. Conceptual Schema representation of the data

   CS-ACTION-LIST

3. Application Program parcel names

   FD-FILE-NAME
   WORK-FILE-NAME

4. Source Language Indicator of the Application Program

   LANG-NO

5. Fortran Variable Association Table

   FORTRAN-VARIABLE-TABLE

32.2 CDM Requirements

None

32.3 Internal Requirements

None

32.4 Processing

1. For each projected entry in the ES action list, generate a program variable to hold the results of the NDML query.

   1.1 Generate variables to hold the null flags if results are to be written to a user file. If ES-FILE-NAME not = space, for each projected field generate if COBOL:

   ```
   03 ES-NULL-ccc-nn PIC 9.
   ```

   where

   ```
   ccc = CS-NDML-NO
    nn = ES-INDEX
   ```

   Add 1 to TOTAL-SIZE to compute actual number of non-deleted ES entries.

   1.2 Generate a group item for retrieved data fields to be stored in a file. If ES-FILE-NAME not = space generate if COBOL:

   ```
   03 CDM-RESULTS-RECORD-eee
   ```

   where

   ```
   eee = ES-NDML-NO
   ```

   1.3 Generate 05 entries for each projected field in the ES-ACTION list. Generate if ES-FILE-NAME not = space into WORK parcel if COBOL:

   ```
   05 ES-RES-RECORD-ccc-nn   PIC clause.
   ```

   where

   ```
   ccc    = CS-NDML-NO
   nn     = ES-INDEX
   clause = picture clause from table below
   ```

Add appropriate total size from table below to TOTAL-SIZE.

1.4 If language is FORTRAN and ES-FILE-NAME not = spaces, generate:

```
CHARACTER*tt  CDM-RESULTS-REC-ee
INTEGER       CDM-RECORD-LENGTH-ee
DATA          CDM-RECORD-LENGTH  /tt/
```

where tt = TOTAL-SIZE
      ee = ES-NDML-NO

1.5 If language is COBOL and ES-FILE-NAME not = spaces, generate:

```
01  CDM-RECORD-LENGTH-ee  PIC S9(9) COMP VALUE tt.

01  CDM-RESULTS-ee.
```

where ee = ES-NDML-NO
      tt = TOTAL-SIZE

1.6 Generate 05 entries for each projected field in the ES-ACTION-LIST. If COBOL, generate:

```
05  ES-RES-ccc-nn  PIC clause.
```

where cc = CS-NDML-NO
      nn = ES-INDEX
  clause = picture clause from table below

Else, if FORTRAN, and function is COUNT, or ES-TYPE equals "C", don't generate anything.

If function is MEAN, AVG, or SUM, generate:

```
DOUBLE PRECISION  ES-RES-ccc-nn
CHARACTER*18      LONG-ES-RES-ccc-nn
```

Else, if ES-TYPE equals "I", generate:
```
INTEGER*ii  ES-RES-ccc-nn
```
Else, if ES-TYPE equals "F", generate
```
DOUBLE PRECISION  ES-RES-ccc-nn
CHARACTER*18      LONG-ES-RES-ccc-nn
```

```
where ccc = CS-NDML-NO
      nn  = IS-INDEX
      ss  = ES-SIZE
      ii  = 4 if ES-S-ZE >4
            2 if ES-SIZE <=4
```

Add appropriate size to TOTAL-SIZE.

1.7 If language is FORTRAN, generate:

```
CHARACTER*tt  CDM-RESULTS-ee

where tt = TOTAL-SIZE
      ee = ES-NDML-NO
```

1.8 If language if FORTRAN, perform steps 1.8.1 through 1.8.4 for each ES-ACTION entry that is projected, has ES-TYPE not equal "C", and ES-FCTN-NAME not equal "COUNT."

1.8.1 Calculate START-POS by summing up sizes of the ES entries up to the one currently pointed to by ES-INDEX. Use the following criteria:

```
If ES-FCTN-NAME equals "COUNT", add 9 to
       START-POS.
Else, if ES-FCTN-NAME equals "SUM", "AVG", or
       "MEAN",    add 8 to START-POS.
Else, if ES-TYPE equals "I" and ES-SIZE is
       greater than    4, add 4 to START-POS.
Else, if ES-TYPE equals "I" and ES-SIZE is
       less than    5, add 2 to START-POS.
Else, if ES-TYPE equals "F", add 8 to
       START-POS.
Else, if ES-TYPE equals "C", add ES-SIZE to
       START-POS.
```

1.8.2 Add 1 to START-POS.

1.8.3 Calculate END-POS using the following criteria:

```
If ES-FCTN-NAME equals "MEAN", "SUM", or "AVG",
       set END-POS equal to START-POS plus 7.
Else, if ES-TYPE equals "I" and ES-SIZE is
       greater than 4, set END-POS equal to
       START-POS plus 3.
Else, if ES-TYPE equals "I" and ES-SIZE is less
       than 5, set END-POS equal to START-POS
       plus 1.
Else, if ES-TYPE equals "F", set END-POS equal
       to START-POS plus 7.
```

1.8.4 Generate:

```
EQUIVALENCE (CDM-RESULTS-ee(sp:ep),
       ES-RES-cc-nn)
       where ee = ES-NDML-NO
             sp = START-POS
             ep = END-POS
             cc = CS-NDML-NO
```

NOTE: Generate the following PIC clause for functions and calculate TOTAL-SIZE:

ES-FCTN-NAME	PIC clause	TOTAL-SIZE
" "	CDPIC generated	ES-SIZE
COUNT	S9(9)	9
MEAN	S9(9)V9(9)	18
AVG	S9(9)V9(9)	18
SUM	S9(9)V9(9)	18
MIN	CDPIC generated	ES-SIZE
MAX	CDPIC generated	ES-SIZE

32.5 Outputs

1. Error status of the function

   RETURN-STATUS

2. Generated code in the WORK parcels.

SECTION 33

FUNCTION CDEC - Generate External/Conceptual Transformation

This routine will generate code required for the transformation of search or update data items to their corresponding conceptual attributes.

CDEC generates either ANSI X3.23-1974 COBOL or ANSI X3.9-1978 Fortran source code.

For COBOL programs, CDEC generates working storage and procedure division code. For Fortran programs, CDEC generates type statements and executable statements.

NOTE: If the user's application program is written in FORTRAN, then as of release 2.3, all FORTRAN variable names will be generated with a length of six. This will be done by generating names of the convention: CDMXXX where XXX is any combination of three characters. The three character combination is determined by routine CDCREFO. This routine associates a six character FORTRAN variable with the corresponding COBOL variable. This association between the COBOL name and the generated FORTRAN name is stored in the FORTRAN-VARIABLE-TABLE. The FORTRAN-VARIABLE-TABLE is copied into modified user's application program. In this design specification, the COBOL name will be used to show how the FORTRAN code will be generated.

33.1 Inputs

1. LANG-NO included in LANG-NO copy member

   If this parameter contains the value 1, COBOL source code is to be generated.

   If this parameter contains the value -1, Fortran source code is to be generated.

2. WORK-FILE-NAME PIC X(30)

   This parameter contains the name of the file where COBOL working storage or Fortran type statements are generated.

3. PROC-FILE-NAME PIC X(30)

   This parameter contains the name of the file where COBOL or Fortran executable statements will be generated.

4. NEXT-PARAMETER-NUMBER PIC 9(3)

   This parameter is both an input and output parameter. It contains the number of the last parameter which was generated in the request processor. It is incremented prior to the generation of a new parameter.

5. CLIST-INDEX PIC 99

   This parameter contains the index value of either the CS-ACTION-LIST or CS-QUALIFY-LIST entry which describes the transformed external field.

6. ELIST-INDEX PIC 99

   This parameter contains the index value of either the ES-ACTION-LIST entry or ES-QUALIFY-LIST entry which describes the external field to be transformed.

7. ACTION-TYPE PIC X

   This parameter contains the CS action to be performed.

8. ES-ACTION-TYPE PIC X

   This parameter contains the ES action to be performed.

9. ES-NDML-NO PIC 999

   This number uniquely identifies the user's NDML request.

10. CS-NDML-NO PIC 9(6)

    This number uniquely defines the case in a logical unit of work.

11. DI-NO PIC 9(6)

    This parameter contains the internal identifier of the external data item.

12. AUC-NO PIC 9(6)

    This parameter contains the internal identifier of the conceptual attribute use class.

13. VAR-OR-FILE-IND PIC X

    This parameter is used to determine whether key uniqueness and type 1 referentional integrity tests for inserts as well as the insert itself have their values coming from user variables and constant values (VAR-OR-FILE-IND equals V) or from a user structure or file (VAR-OR-FILE-IND equals F).

14. FORTRAN-VARIABLE-TABLE

    This table contains the FORTRAN variables that have been defined. Associated with each of these variables in the table is the coresponding COBOL variable.

15. TARGET-HOST PIC XXX.

    This variable is used if the source language is FORTRAN in the calls to CDMACR. It must know whether to use IBMFORTRAN or VAXFORTRAN as the library name.

33.2 CDM Requirements

ENTITY CLASS

COMPLEX-MAPPING-PARM
MODULE-PARAMETER
USER-DEF-DATA-TYPE

33.3 Internal Requirements

None

33.4 Processing

1. Open for EXTEND WORK-FILE-NAME.

2. Open for EXTEND PROC-FILE-NAME.

3. Determine whether a complex mapping algorithm exists for the data item/AUC combination.

   3.1 If the following SQL statement returns at least 1 row, a complex mapping exists for the data item/AUC combination.

```
 SELECT MOD_ID, PARM_ID, CONSTANT_VALUE, UNION_DISC

    FROM COMPLEX_MAPPING_PARM

    WHERE ALG_USE_CODE = U AND

    MOD_ID IN

    (SELECT MOD_ID FROM COMPLEX_MAPPING_PARM

    WHERE TAG_NO = :AUC-NO-WS) AND

    MOD_INST IN

(SELECT MOD_INST FROM COMPLEX_MAPPING_PARM

    WHERE TAG_NO = :AUC-NO-WS) AND

    MOD_ID IN
```

```
(SELECT MOD_ID FROM COMPLEX_MAPPING_PARM

WHERE DI_NO = :DI-NO-WS) AND

MOD_INST IN

(SELECT MOD_INST FROM COMPLEX_MAPPING_PARM

WHERE DI_NO = :DI-NO-WS)

ORDER BY PARM_ID
```

4. If the previous SQL statement returned no data, a complex mapping algorithm does not exist for the data item/AUC combination. Single moves from the external variable to the conceptual variable must be generated on PROC-FILE-NAME. No code is generated on WORK-FILE-NAME.

   4.1 If COBOL is to be generated (LANG-NO equals 1), perform the following steps.

      4.1.1 If processing either a key uniqueness test or a type 1 referential integrity test (ACTION-TYPE equals K or 1) for an insert (ES-ACTION-TYPE equals I) and the data will be residing in user variables or constants (VAR-OR-FILE-IND equals V), generate the following code:

```
MOVE ES-VAR-INS-esndml-elist

(CDM-INPUT-INDEX-esndml)
TO CSQ-VAR-csndml-clist
```

      where esndml is the value contained in input parameter ES-NDML-NO, elist is the value contained in input parameter ELIST-INDEX, csndml is the value contained in input parameter CS-NDML-NO and clist is the value contained in input parameter CLIST-INDEX.

      4.1.2 If processing either a key uniqueness test or a type 1 referential integrity test (ACTION-TYPE equals K or 1) for an insert (ES-ACTION-TYPE equals I) and the data will be residing in a file or structure (VAR-OR-FILE-IND equals F), generate the following code:

```
MOVE ES-VAR-INS-esndml-elist
TO CSQ-VAR-csndml-clist
```

      where esndml is the value contained in input parameter ES-NDML-NO, elist is the value contained in input parameter

ELIST-INDEX, csndml is the value contained in input parameter CS-NDML-NO and clist is the value contained in input parameter CLIST-INDEX.

4.1.3 If processing a type 1 referential integrity test (ACTION-TYPE equals 1) for a modify (ES-ACTION-TYPE equals M), generate the following code:

```
MOVE ES-VAR-csndml-elist
TO CSQ-VAR-csndml-clist
```

where csndml is the value contained in input parameter CS-NDML-NO, elist is the value contained in input parameter ELIST-INDEX and clist is the value contained in input parameter CLIST-INDEX.

4.1.4 If processing the qualification for a type 2 referential integrity test or a select or a delete or a modify (ACTION-TYPE equals 2 or S or D or M), generate the following code:

```
MOVE ESQ-VAR-csndml-elist
TO CSQ-VAR-csndml-clist
```

where csndml is the value contained in input parameter CS-NDML-NO, elist is the value contained in input parameter ELIST-INDEX and clist is the value contained in input parameter ELIST-INDEX.

4.1.5 If processing the new column values for a modify (ACTION-TYPE equals U), generate the following code:

```
MOVE ES-VAR-csndml-elist
TO CS-VAR-csndml-clist
```

where csndml is the value contained in input parameter CS-NDML-NO, elist is the value contained in input parameter ELIST-INDEX and clist is the value contained in input parameter CLIST-INDEX.

4.1.6 If processing an insert (ACTION-TYPE equals I) and the data will be residing in user variables or constants (VAR-OR-FILE-IND equals V), generate the following code:

```
MOVE ES-VAR-INS-esndml-elist
          (CDM-INPUT-INDEX-esdml)
TO CS-VAR-csndml-clist
```

where esndml is the value contained in input parameter ES-NDML-NO, elist is the value contained in input parameter ELIST-INDEX, csndml is the value contained in input parameter CS-NDML-NO and clist is the value contained in input parameter CLIST-INDEX.

4.1.7 If processing an insert (ACTION-TYPE equals I) and the data will be residing in a file or structure (VAR-OR-FILE-IND equals F), generate the following code:

```
        MOVE ES-VAR-INS-esndml-elist
        TO CS-VAR-esndml-clist
```

where esndml is the value contained in input parameter es-ndml-no, elist is the value contained in input parameter LIST-INDEX, csndml is the value contained in input parameter CS-NDML-NO and clist is the value contained in input parameter CLIST-INDEX.

4.1.8 Continue processing at step 6.

4.2 If Fortran is to be generated (LANG-NO equals -1), perform the following steps.

4.2.1 If processing either a key uniqueness test or a type 1 referential integrity test (ACTION-TYPE equals K or 1) for an insert (ES-ACTION-TYPE equals I) and the data will be residing in user variables or constants (VAR-OR-FILE-IND equals V), generate the following code:

```
        CSQ-VAR-csndml-clist =
ES-VAR-INS-esndml-elist(CDM-INUT-INDEX-e
sndml)
```

where csndml is the value contained in input parameter CS-NDML-NO, clist is the value contained in input parameter CLIST-INDEX, esndml is the value contained in input parameter ES-NDML-NO and elist is the value contained in input parameter ELIST-INDEX.

4.2.2 If processing either a key uniqueness test or a type 1 referential integrity test (ACTION-TYPE equals K or 1) for an insert (ES-ACTION-TYPE equals I) and the data will be residing in a file or structure (VAR-OR-FILE-IND equals F), generate the following code:

```
        CSQ-VAR-csndml-clist =
ES-VAR-INS-esndml-elist
```

where csndml is the value contained in input parameter CS-NDML-NO, clist is the value contained in input parameter CLIST-INDEX, esndml is the value contained in input parameter ES-NDML-NO and elist is the value contained in input parameter ELIST-INDEX.

4.2.3 If processing a type 1 referential integrity test (ACTION-TYPE equals 1) for a modify (ES-ACTION-TYPE equals M), generate the following code:

```
        CSQ-VAR-csndml-clist =
ES-VAR-csndml-elist
```

where csndml is the value contained in input parameter CS-NDML-NO, clist is the value contained in input parameter CLIST-INDEX and elist is the value contained in input parameter ELIST-INDEX.

4.2.4 If processing the qualification for a type 2 referential integrity test or a select or a delete or a modify (ACTION-TYPE equals 2 or S or D or M), generate the following code:

```
        CSQ-VAR-csndml-clist =
ESQ-VAR-csndml-elist
```

where csndml is the value contained in input parameter CS-NDML-NO, clist is the value contained in input parameter CLIST-INDEX and elist is the value contained in input parameter ELIST-INDEX.

4.2.5 If processing the new column values for a modify (ACTION-TYPE equals U), generate the following code:

```
        CS-VAR-csndml-clist =
ES-VAR-csndml-elist
```

where csndml is the value contained in input parameter CS-NDML-NO, elist is the value contained in input parameter CLIST-INDEX and elist is the value contained in input parameter ELIST-INDEX.

4.2.6 If processing an insert (ACTION-TYPE equals I) and the data will be residing in user variables or constants (VAR-OR-FILE-IND equals V), generate the following code:

```
        CS-VAR-csndml-clist =
ES-VAR-INS-esndml-elist(CDM-INPUT-INDEX-
esndml)
```

where csndml is the value contained in input parameter CS-NDML-NO, clist is the value contained in input parameter CUST-INDEX, esndml is the value contained in input parameter ES-NDML-NO and elist is the value contained in input parameter ELIST-INDEX.

4.2.7 If processing an insert (ACTION-TYPE equals I) and the data will be residing in a file or structure (VAR-OR-FILE-IND equals F), generate the following code:

```
        CS-VAR-csndml-clist =
ES-VAR-INS-esndml-elist
```

where csndml is the value contained in input parameter CS-NDML-NO, clist is the value contained in input parameter CLIST-INDEX, esndml is the value contained in input parameter ES-NDML-NO and elist is the value contained in input parameter ELIST-INDEX.

4.2.8 Continue processing at step 6.

5. If data was returned from SQL statement 1, a complex mapping algorithm exists for the data item/AUC combination.

5.1 Initialize the following structure.

```
01 PARAMETER-TABLE
   03 PARM-USED         PIC 99.
   03 PARM-MAX          PIC 99 VALUE 25.
   03 PARM-ENTRY OCCURS 25 TIMES INDEXED BY
PARM-INDEX.
      05 PARM-NAME      PIC X(30).
```

Set PARM-USED to zero and all PARM-NAME entries to spaces.

5.2 If COBOL is to be generated (LANG-NO equals 1), perform the following steps:

5.2.1 If the current UNION-DISC from SQL statement 1 execution equals "5" indicating a data item, perform the following steps.

5.2.1.1 Generate a working storage entry for the data item.

Perform the following SQL statement to extract type, size, and number of decimal digits of the parameter from the CDM:

```
       SELECT TYPE_ID, MAX_SIZE,

              NO_OF_DECIMALS
       FROM USER_DEF_DATA_TYPE
A,
                        MODULE_PA
RAMETER B
       WHERE MOD_ID =
:SQL1-MOD-ID AND
               PARM_ID =
:SQL1-PARM-ID AND
                         B.DATA_TY
PE_NAME = A.DATA_TYPE_NAME
```

where SQL1-MOD-ID is the MOD-ID retrieved from SQL statement 1 and SQL1-PARM-ID is the PARM-ID from SQL statement 1.

Increment the input parameter NEXT-PARAMETER-NUMBER by 1.

Generate the following working storage entry in WORK-FILE-NAME.

```
               01 PARM-npn
PIC clause
```

where npn is the current value of input parameter NEXT-PARAMETER-NUMBER and PIC clause is the picture clause generated by CDPIC. Send CDPIC the current TYPE-ID, MAX-SIZE and NO-OF-DECIMALS from SQL statement 2.

5.2.1.2 Add the parameter name to the PARAMETER-TABLE.

Increment PARM-USED by 1.

Generate the following parameter name into PARM-NAME (PARM-USED):

PARM-npn

where npn is the value of NEXT-PARAMETER-NUMBER.

5.2.1.3 If processing either a key uniqueness test or a type 1 referential integrity test (ACTION-TYPE equals K or 1) for an insert (ES-ACTION-TYPE equals I) and the data will be residing in user variables or constants (VAR-OR-FILE-IND equals V), generate the following MOVE statement into PROC-FILE-NAME:

```
MOVE ES-VAR-INS-esndml-elist
(CDM-INPUT-INDEX-esndml)
TO PARM-npn
```

where esndml is the value contained in input parameter ES-NDML-NO, elist is the value contained in input parameter ELIST-INDEX and npn is the current value of NEXT-PARAMETER-NUMBER.

5.2.1.4 If processing either a key uniqueness test or a type 1 referential integrity test (ACTION-TYPE equals K or 1) for an insert (ES-ACTION-TYPE equals I) and the data will be residing in a file or structure (VAR-OR-FILE-IND equals F), generate the following MOVE statement into PROC-FILE-NAME:

```
MOVE ES-VAR-INS-esndml-elist TO
PARM-npn
```

where esndml is the value contained in input parameter ES-NDML-NO, elist is the value contained in input parameter ELIST-INDEX and npn is the current value of NEXT-PARAMETER-NUMBER.

5.2.1.5 If processing a type 1 referential integrity test (ACTION-TYPE equals 1) for a modify (ES-ACTION-TYPE equals M), generate the following MOVE statement into PROC-FILE-NAME:

MOVE ES-VAR-csndml-elist TO PARM-npn

where csndml is the value contained in input parameter CS-NDML-NO, elist is the value contained in input parameter ELIST-INDEX and npn is the value of NEXT-PARAMETER-NUMBER.

5.2.1.6 If processing the qualification for a type 2 referential integrity test or a select or a delete or a modify (ACTION-TYPE equals 2 or S or D or M), generate the following MOVE statement or PROC-FILE-NAME:

MOVE ESQ-VAR-csndml-elist TO PARM-npn

where csndml is the value contained in input parameter CS-NDML-NO, elist is the value contained in input parameter ELIST-INDEX and npn is the value contained in NEXT-PARAMETER-NUMBER.

5.2.1.7 If processing the new column values for a modify (ACTION-TYPE equals U), generate the following MOVE statement on PROC-FILE-NAME:

MOVE ES-VAR-csndml-elist TO PARM-npn

where csndml is the value contained in input parameter CS-NDML-NO, elist is the value contained in input parameter NEXT-PARAMETER-NUMBER.

5.2.1.8 If processing an insert (ACTION-TYPE equals I) and the data will be residing in user variables or constants (VAR-OR-FILE-IND equals V), generate the following MOVE statement into PROC-FILE-NAME:

MOVE ES-VAR-INS-esndml-elist (CDM-INPUT-INDEX-esndml) TO PARM-npn

where esndml is the value contained in input parameter ES-NDML-NO, elist is the value contained in input parameter ELIST-INDEX and npn is the value contained in NEXT-PARAMETER-NUMBER.

5.2.1.9 If processing an insert (ACTION-TYPE equals I) and the data will be residing in a file or structure (VAR-OR-FILE-IND equals F), generate the following MOVE statement into PROC-FILE-NAME:

```
MOVE ES-VAR-INS-esndml-elist TO
PARM-npn
```

where esndml is the value contained in input parameter ES-NDML-NO, elist is the value contained in input parameter ELIST-INDEX and npn is the value contained in NEXT-PARAMETER-NUMBER.

5.2.1.10 Fetch the next row from SQL statement 1. If another row is successfully fetched, continue processing at step 5.2.1. If no MOVE rows are successfully fetched, continue processing at 5.2.4.

5.2.2 If the current UNION-DISC from SQL statement 1 execution equals "1" indicating a tag, perform the following steps:

5.2.2.1 Generate a working storage entry for the tag.

Extract type, size and number of decimals for the parameter by executing SQL statement 2 as described in step 5.2.1.1.

Increment the input parameter NEXT-PARAMETER-NUMBER by 1. Remember this value for later use in step 5.2.5.

Generate the following working storage entry in WORK-FILE-NAME:

```
01 PARM-npn       PIC clause
```

where npn is the current value of input parameter NEXT-PARAMETER-NUMBER and PIC clause is the picture clause generated by CDPIC. Send CDPIC the current TYPE-ID, MAX-SIZE and NO-OF-DECIMALS from SQL statement 2.

5.2.2.2 Add the parameter name to the PARAMETER-TABLE.

Increment PARM-USED by 1.

Generate the following parameter name into PARM-NAME(PARM-USED):

PARM-npn

where npn is the value of NEXT-PARAMETER-NUMBER.

5.2.2.3 Fetch the next row from SQL statement 1. If another row is successfully fetched, continue processing at 5.2.1. If no MOVE rows are successfully fetched, continue processing at step 5.2.4.

5.2.3 If the current UNION-DISC from SQL statement 1 equals "2" indicating a constant, perform the following steps:

5.2.3.1 Generate a working storage entry for the constant.

Extract type, size and number of decimals for the parameter by executing SQL statement 2 as described in step 5.2.1.1.

Increment the input parameter NEXT-PARAMETER-NUMBER by 1.

Generate the following working storage entry in WORK-FILE-NAME:

```
01 PARM-npn      PIC clause
```

where npn is the current value of input parameter NEXT-PARAMETER-NUMBER and PIC clause is the picture clause generated by CDPIC. Send CDPIC the current TYPE-ID, MAX-SIZE and NO-OF-DECIMALS from SQL statement 2.

5.2.3.2 Add the constant's name to the PARAMETER-TABLE.

Increment PARM-USED by 1.

Generate the following parameter name into PARM-NAME (PARM-USED):

PARM-npn

where npn is the value of NEXT-PARAMETER-NUMBER.

5.2.3.3 Generate the move of the constant value into the constant parameter name.

If the TYPE-ID of the constant equals C, generate the following code into PROC-FILE-NAME:

```
MOVE "constval" TO PARM-npn
```

where constval is the current CONSTANT-VALUE from SQL statement 1 and npn is the current value of NEXT-PARAMETER-NUMBER.

Place the quote marks around the CMA-CONST-VAL to generate a character literal.

If the TYPE-ID of the constant does not equal C, generate the following code into PROC-FILE-NAME:

```
MOVE constval TO PARM-npn
```

where constval is the current CONSTANT-VALUE from SQL statement 1 and npn is the current value of NEXT-PARAMETER-NUMBER.

5.2.3.4 Fetch the next row from SQL statement 1. If another row is successfully fetched, continue processing at 5.2.1. If no MOVE rows are successfully fetched, continue processing at step 5.2.4.

5.2.4 Generate the call to the user module.

5.2.4.1 Generate the following code on PROC-FILE-NAME:

```
CALL "mod" USING
```

where mod is the current MOD-ID from SQL statement 1.

5.2.4.2 For each used PARM-NAME, generate a parameter call list entry on PROC-FILE-NAME.

```
parm1
   .
   .
   .
parmn
```

where parm1 through parmn are the values contained in all used PARM-NAME entries.

5.2.4.3 Generate the status parameter and terminating period on PROC-FILE-NAME.

```
RET-STATUS.
```

5.2.4.4 Generate the status checking logic on PROC-FILE-NAME.

```
MOVE RET-STATUS TO NDML-STATUS
IF RET-STATUS NOT = KES-SUCCESSFUL
STRING "mod"
" TRANSFORM PROGRAM FAILED"
DELIMITED BY SIZE INTO MESG-DESC
PERFORM PROCESS-ERROR
GO TO END-NDML-esndml.
```

where mod is the current MOD-ID from SQL statement 1 and esndml is the value of input parameter ES-NDML-NO.

5.2.5 Generate the MOVE from the module output parameter to the conceptual variable.

5.2.5.1 If processing a type 1 referential integrity test or a key uniqueness test (ACTION-TYPE equals 1 or K) for an insert (ES-ACTION-TYPE equals I), generate the following MOVE statement into PROC-FILE-NAME

```
MOVE PARM-npn TO CSQ-VAR-csndml-clist
```

where npn is the value remembered from step 5.2.2.1, csndml is the value contained in input parameter CS-NDML-NO and clist is the value contained in input parameter CLIST-INDEX.

5.2.5.2 If processing a type 1 referential integrity test (ACTION-TYPE equals 1) for a modify (ES-ACTION-TYPE equals M), generate the following MOVE statement into PROC-FILE-NAME

```
MOVE PARM-npn TO CSQ-VAR-csndml-clist
```

where npn is the value remembered from step 5.2.2.1, csndml is the value contained in input parameter CS-NDML-NO and clist is the value contained in input parameter CLIST-INDEX.

5.2.5.3 If processing the qualification for a type 2 referential integrity test or a select or a delete or a modify (ACTION-TYPE equals 2 or S or D or M), generate the following MOVE statement into PROC-FILE-NAME:

```
MOVE PARM-npn TO CSQ-VAR-csndml-clist
```

where npn is the value remembered from step 5.2.2.1, csndml is the value contained in input parameter CS-NDML-NO and clist is the value contained in input parameter CLIST-INDEX.

5.2.5.4 If processing the new column values for a modify (ACTION-TYPE equals U), generate the following MOVE statement into PROC-FILE-NAME:

```
MOVE PARM-npn TO CS-VAR-csndml-clist
```

where npn is the value remembered from step 5.2.2.1, csndml is the value contained in input parameter CS-NDML-NO and clist is the value contained in input parameter CLIST-INDEX.

5.2.5.5 If processing an insert (ACTION-TYPE equals I), generate the following MOVE statement into PROC-FILE-NAME:

```
MOVE PARM-npn TO CS-VAR-csndml-clist
```

where npn is the value remembered from step 5.2.2.1, csndml is the value contained in input parameter CS-NDML-NO and clist is the value contained in input parameter CLIST-INDEX.

5.2.6 Continue processing at step 6.

5.3 If Fortran is to be generated (LANG-NO = -1), perform the following steps.

5.3.1 If the current UNION-DISC from SQL statement 1 execution equals "5" indicating a data item, perform the following steps.

5.3.1.1 Generate a type declaration for the data item.

Extract type, size and number of decimals from SQL statement 2 as described in step 5.2.1.1.

Increment the input parameter NEXT-PARAMETER-NUMBER by 1.

If the TYPE-ID returned from SQL statement 2 equals C, generate the following statement in WORK-FILE-NAME:

```
CHARACTER*maxsize    PARM-npn
```

where maxsize is the value of MAX-SIZE from SQL statement 2 and npn is the value contained in NEXT-PARAMETER-NUMBER.

If the TYPE-ID returned from SQL statement 2 equals I, generate the following statement in WORK-FILE-NAME:

```
INTEGER PARM-npn
CHARACTER*6  CHAR-PARM-npn
```

where npn is the value contained in NEXT-PARAMETER-NUMBER.

If the TYPE-ID returned from SQL statement 2 equals F, generate the following in WORK-FILE-NAME:

```
REAL*sizeno         PARM-npn
CHARACTER*maxsize
CHAR-PARM-npn
```

where npn is the value contained in NEXT-PARAMETER-NUMBER, maxsize is the value contained in MAX-SIZE, and sizeno is 16 if MAX-SIZE > 15, or 8 if MAX-SIZE > 7, or 4 if MAX-SIZE < 7.

5.3.1.2 Add the parameter name to the PARAMETER-TABLE.

Increment PARM-USED by 1.

Generate the following parameter name into PARM-NAME (PARM-USED):

CHAR-PARM-npn	if TYPE-ID = "I"
PARM-npn	otherwise

where npn is the value of NEXT-PARAMETER-NUMBER.

5.3.1.3 If processing either a key uniqueness test or a type 1 referential integrity test (ACTION-TYPE equals K or 1) for an insert (ES-ACTION-TYPE equals I) and the data will be residing in user variables or constants (VAR-OR-FILE-IND equals V), generate the following statement into PROC-FILE-NAME:

```
PARM-npn =
ES-VAR-INS-esndml-elist(CDM-INPU
T-INDEX-esndml)
```

where npn is the value of NEXT-PARAMETER-NUMBER, esndml is the value contained in input parameter ES-NDML-NO and elist is the value contained in input parameter ELIST-INDEX.

5.3.1.4 If processing either a key uniqueness test or a type 1 referential integrity test (ACTION-TYPE equals K or 1) for an insert (ES-ACTION-TYPE equals I) and the data will be residing in a file or structure (VAR-OR-FILE-IND equals F), generate the following statement into PROC-FILE-NAME:

```
PARM-npn =
ES-VAR-INS-esndml-elist
```

where npn is the value of NEXT-PARAMETER-NUMBER, esndml is the value contained in input parameter ES-NDML-NO and elist is the value contained in input parameter ELIST-INDEX.

5.3.1.5 If processing a type 1 referential integrity test (ACTION-TYPE equals 1) for a modify (ES-ACTION-TYPE equals M), generate the following statement into PROC-FILE-NAME:

```
PARM-npn = ES-VAR-csndml-elist
```

where npn is the value of NEXT-PARAMETER-NUMBER, csndml is the value contained in input parameter CS-NDML-NO and elist is the value contained in input parameter ELIST-INDEX.

5.3.1.6 If processing the qualification for a type 2 referential integrity test or a select or a delete or modify (ACTION-TYPE equals 2 or S or D or M), generate the following statement into PROC-FILE-NAME:

```
PARM-npn = ESQ-VAR-csndml-elist
```

where npn is the value of NEXT-PARAMETER-NUMBER, csndml is the value contained in input parameter CS-NDML-NO and elist is the value contained in input parameter ELIST-INDEX.

5.3.1.7 If processing an insert (ACTION-TYPE equals I) and the data will be residing in user variables or constants (VAR-OR-FILE-IND equals V), generate the following statement into PROC-FILE-NAME:

```
PARM-npn =
ES-VAR-INS-esndml-elist(CDM-INPU
T-INDEX-esndml)
```

where npn is the value of NEXT-PARAMETER-NUMBER, esndml is the value contained in input parameter ES-NDML-NO and elist is the value contained in input parameter ELIST-INDEX.

5.3.1.8 If processing an insert (ACTION-TYPE equals I) and the data will be residing in a file or structure (VAR-OR-FILE-IND equals F), generate the following statement into PROC-FILE-NAME:

PARM-npn =
ES-VAR-INS-esndml-elist

where npn is the value of NEXT-PARAMETER-NUMBER, esndml is the value contained in input parameter ES-NDML-NO and elist is the value contained in input parameter ELIST-INDEX.

5.3.1.9 Fetch the next row from SQL statement 1. If another row is successfully fetched, continue processing at step 5.3.1. If no more rows are successfully fetched, continue processing at step 5.3.4.

5.3.2 If the current UNION-DISC from SQL statement 1 execution equals "1" indicating a tag, perform the following steps:

5.3.2.1 Generate a type declaration for the tag.

Extract type, size and number of decimal digits by executing SQL statement 2 as described in step 5.2.1.1.

Increment the input parameter NEXT-PARAMETER-NUMBER by 1. Remember this value for later use in step 5.7.5.

If the TYPE-ID returned from SQL statement 2 equals C, generate the following statement in WORK-FILE-NAME:

```
CHARACTER*maxsize  PARM-npn
```

where maxsize is the value of MAX-SIZE from SQL statement 2 and npn is the value contained in NEXT-PARAMETER-NUMBER.

If the TYPE ID returned from SQL statement 2 equals I, generate the following statement in WORK-FILE-NAME:

```
INTEGER     PARM-npn
CHARACER*6  CHAR-PARM-npn
```

where npn is the value contained in NEXT-PARAMETER-NUMBER.

If the TYPE-ID returned from SQL statement 2 equals F, generate the following statement in WORK-FILE-NAME:

```
REAL*sizeno            PARM-npn
CHARACTER*maxsize      CHAR-PARM-npn
```

where npn is the value contained in NEXT-PARAMETER-NUMBER, maxsize is the value contained in MAX-SIZE, and sizeno is 16 if MAX-SIZE > 15, or 8 if MAX-SIZE > 7, or 4 if MAX-SIZE < 7.

5.3.2.2 Add the parameter name to the PARAMETER-TABLE.

Increment PARM-USED by 1.

Generate the following parameter name into PARM-NAME (PARM-USED)

```
CHAR-PARM-npn    if TYPE-ID = "I"
PARM-npn         otherwise
```

where npn is the value of NEXT-PARAMETER-NUMBER.

5.3.2.3 Fetch the next row from SQL statement 1. If another row is successfully fetched, continue processing at step 5.3.1. If no more rows are successfully fetched, continue processing at step 5.3.4.

5.3.3. If the current UNION-DISC from SQL statement 1 equals "2" indicating a constant, perform the following steps:

5.3.3.1 Generate a type declaration for the constant.

Extract type, size and number of decimal digits by executing SQL statement 2 as described in step 5.2.1.1.

Increment the input parameter NEXT-PARAMETER-NUMBER by 1.

If the TYPE-ID returned from SQL statement 2 equals C, generate the following statement in WORK-FILE-NAME:

```
CHARACTER*maxsize   PARM-npn
```

where maxsize is the value of MAX-SIZE from SQL statement 2 and npn is the value contained in NEXT-PARAMETER-NUMBER.

If the TYPE-ID returned from SQL statement 2 equals I, generate the following statement in WORK-FILE-NAME:

```
INTEGER        PARM-npn
CHARACTER*6    CHAR-PARM-npn
```

where npn is the value contained in NEXT-PARAMETER-NUMBER.

If the TYPE-ID returned from SQL statement 2 equals F, generate the following statement in WORK-FILE-NAME:

```
REAL*sizeno            PARM-npn
CHARACTER*maxsize      CHAR-PARM-npn
```

where npn is the value contained in NEXT-PARAMETER-NUMBER, maxsize is the value contained in MAX-SIZE, and sizeno is 16 if MAX-SIZE > 15, or 8 if MAX-SIZE > 7, or 4 if MAX-SIZE < 7.

5.3.3.2 Add the constant's name to the PARAMETER-TABLE.

Increment PARM-USED by 1.

Generate the following parameter name into PARM-NAME (PARM-USED):

```
CHAR-PARM-npn     if TYPE-ID =
"I"
PARM-npn          otherwise
```

where npn is the value of NEXT-PARAMETER-NUMBER.

5.3.3.3 Generate the assignment of the constant value into the constant parameter name.

If the TYPE-ID of the constant equals C, generate the following code into PROC-FILE-NAME:

```
PARM-npn = 'constval'
```

where npn is the current value of NEXT-PARAMETER-NUMBER and constval is the current CONSTANT-VALUE from SQL statement 1.

If the TYPE-ID of the constant does not equal C, generate the following code into PROC-FILE-NAME:

```
PARM-npn = constval
```

where npn is the current value of NEXT-PARAMETER-NUMBER and constual is the current CONSTANT-VALUE from SQL statement 1.

5.3.3.4 Generate a call to a routine to convert the data from numeric to character data, if it already isn't character.

If TYPE-ID equals "I", generate:

```
Call INTFTN(PARM-npn,
CHAR-PARM-npn)
```

where npn is the current value of NEXT-PARAMETER-NO

If TYPE-ID equals "F", generate:

```
DECIML = 00
Call RECFIN(DECIML, PARM-npn,
CHAR-PARM-npn)
```

where npn is the current value of NEXT-PARAMETER-NO

5.3.3.5 Fetch the next row from SQL statement 1. If another row is successfully fetched, continue processing at step 5.3.1. If no more rows are successfully fetched, continue processing at step 5.3.4.

5.3.4 Generate the call to the user module.

5.3.4.1 Generate the following code on PROC-FILE-NAME:

```
CALL mod (
```

where mod is the current MOD-ID from SQL statement 1.

5.3.4.2 For each used PARM-NAME, generate a continuation marker (* in column 6) followed by a parameter call list entry on PROC-FILE-NAME followed by a comma.

If TARGET-HOST equals VAX:

```
     * parm1,
         .
         .
         .
     * parmn,
```

If TARGET-HOST equals IBM:

```
     *%REF(parm1),
         .
         .
         .
     *%REF(parmn),
```

where parm1 through parmn are the values contained in all used PARM-NAME entries.

5.3.4.3 Generate a continuation marker, the status variable and the terminating parenthesis on PROC-FILE-NAME

If TARGET-HOST equals VAX:

```
     * NDMLST)
```

If TARGET-HOST equals IBM:

```
     *%REF(NDMLST))
```

5.3.4.4 Generate the status checking logic on PROC-FILE-NAME.

```
IF (NDMLST .NE. '00000') THEN
   GO TO 93esndml
ENDIF
```

where mod is the current MOD-ID from SQL statement 1 and esndml is the value of input parameter ES-NDML-NO.

5.3.5 Generate the assignment of the module output parameter to the conceptual variable.

5.3.5.1 If processing a type 1 referential integrity test or a key uniqueness test (ACTION-TYPE equals 1 or K) for an insert

(ES-ACTION-TYPE equals I), generate the following statement on PROC-FILE-NAME:

CSQ-VAR-csndml-clist = PARM-npn

where csndml is the value contained in input parameter CS-NDML-NO, clist is the value contained in input parameter CLIST-INDEX and npn is the value remembered from step 5.3.2.1.

5.3.5.2 If processing a type 1 referential integrity test (ACTION-TYPE equals 1) for a modify (ES-ACTION-TYPE equals M), generate the following statement on PROC-FILE-NAME:

CSQ-VAR-csndml-clist = PARM-npn

where csndml is the value contained in input parameter CS-NDML-NO, clist is the value contained in input parameter CLIST-INDEX and npn is the value remembered from step 5.3.2.1.

5.3.5.3 If processing the qualification for a type 2 referential integrity test or a select or a delete or a modify (ACTION-TYPE equals 2 or S or D or M), generate the following statement on PROC-FILE-NAME:

CSQ-VAR-csndml-clist = PARM-npn

where csndml is the value contained in input parameter CS-NDML-NO, clist is the value contained in input parameter CLIST-INDEX and npn is the value remembered in step 5.3.2.1.

5.3.5.4 If processing the new column values for a modify (ACTION-TYPE equals U), generate the following statement on PROC-FILE-NAME:

CS-VAR-csndml-clist = PARM-npn

where csndml is the value contained in input parameter CS-NDML-NO, clist is the value contained in input parameter CLIST-INDEX and npn is the value remembered in step 5.3.2.1.

5.3.5.5 If processing an insert (ACTION-TYPE equals I), generate the following statement on PROC-FILE-NAME:

```
CS-VAR-csndml-clist = PARM-npn
```

where csndml is the value contained in input parameter CS-NDML-NO, clist is the value contained in input parameter CLIST-INDEX and npn is the value remembered in step 5.3.2.1.

6. Close WORK-FILE-NAME and PROC-FILE-NAME.

7. Terminate processing.

33.5 Outputs

1. RET-STATUS PIC X(5)

   Error status. A value equal to KES-SUCCESSFUL as defined in the ERRCDM copy marker indicates success.

SECTION 34

FUNCTION CDECWS - Generate Data Definitions for runtime update/search values.

This function will:

1. Generate External/Conceptual Schema Data Defintions for runtime
   insert, modify and qualify data values.

2. Generate code into the Working Storage section of the modified AP. Depending on CS-ACTION-TYPE the following code will be generated:

```
01    CS-VAR-ccc-nn     PIC type(size)[V9(nd)]
01    CSQ-VAR-ccc-nn    PIC type(size)[V9(nd)]
01    ES-VAR-ccc-nn     PIC type(size)[V9(nd)]
01    ESQ-VAR-ccc-nn    PIC type(size)[V9(nd)]
```

NOTE: If the user's application program is written in FORTRAN, then as of release 2.3, all FORTRAN variable names will be generated with a length of six. This will be done by generating names of the convention: CDMXXX where XXX is any combination of three characters. The three character combination is determined by routine CDCREFO. This routine associates a six character FORTRAN variable with the corresponding COBOL variable. This association between the COBOL name and the generated FORTRAN name is stored in the FORTRAN-VARIABLE-TABLE. The FORTRAN-VARIABLE-TABLE is copied into modified user's application program. In this design specification, the COBOL name will be used to show how the FORTRAN code will be generated.

34.1 Inputs

1. Source Language Indicator of the Application Program

   LANG-NO

2. Application Program parcel names

   WORK-FILE-NAME

3. Conceptual Schema representation of the data

   CS-ACTION-LIST
   CS-QUALIFY-LIST

4. External Schema representation of the data

   ES-ACTION-LIST
   ES-QUALIFY-LIST

5. Fortran Variable Association Table

FORTRAN-VARIABLE-TABLE

34.2 CDM Requirements

None

34.3 Internal Requirements

None

34.4 Processing

1. Generate Conceptual schema definitions for CS-ACTION of "1" or "K".
   Scan CS-QUALIFY list for

```
CSQ-ECNOR = 0
CSQ-AUCR = 0
CSQ-ES-PTR NOT = 0
```

1.1 Generate 01 level for table containing qualify values if entries were found. If language is COBOL, generate:

```
01 CDM-CSQ-TABLE-ccc
```

Else, generate:

```
CHARACTER*tt   CDM-CSQ-TABLE-ccc
```

where

ccc = CS-NDML-NO
tt = total size of all entries found in the above scan.

1.2 Generate the following using the same process as in scan above. If language is COBOL, generate:

```
03 CSQ-VAR-ccc-ii   PIC clause.
```

where

ccc = CS-NDML-NO
ii = CSQ-INDEX
PIC clause = meta data from current CSQ entry (L)

else perform steps 2.2.1 through 2.2.2.

1.2.1 If CSQ-L-TYPE is equal "C", generate:

```
CHARACTER*11   CSQ-VAR-ccc-nn
```

Else, generate:

```
DOUBLE PRECISION  CSQ-VAR-ccc-nn
CHARACTER*ll      XHQcccnn
CHARACER*ss       CSQ-LONG-VAR-ccc-nn

where ll  = CSQ-L-SIZE
      ccc = CS-NDML-NO
      nn  = CSQ-INDEX
      ss  = CSQ-L-SIZE + 1
```

1.2.2 If ES-ACTION not Insert, generate additional code.

1.2.2.1 If ES-TYPE is equal "C", generate:

```
CHARACTER*ee   ES-VAR-ccc-nn
```

Else, generate:

```
DOUBLE PRECISION  ES-VAR-ccc-nn
CHARACTER*ee      XHScccnn

where ee  = ES-SIZE
      ccc = ES-NDML-NO
      nn  = CSQ-ES-PTR
```

1.3 If nothing was generated in step 2.1 generate if COBOL:

```
01 CDM-CSQ-TABLE-ccc   PIC X.
```

else if FORTRAN, generate:

```
CHARACTER*1  CDM-CSQ-TABLE-ccc
```

where

```
ccc = CS-NDML-NO
```

2. Generate External Schema definitions for CS-ACTION of "1" or "K" if language is COBOL.

2.1 Scan CS-QUALIFY list for

```
CSQ-ECNOR = 0
CSQ-AUCR = 0
CSQ-ES-PTR NOT = 0
```

For each entry found generate:

```
01   ES-VAR-ccc-nn    PIC type(size)(nd).
```

where

```
ccc = CS-NDML-NO
nn  = CSQ-ES-PTR
```

Call CDPIC to generate picture clause using meta data in the ES-ACTION-LIST.

```
ES-INDEX = CSQ-ES-PTR
```

3. Generate Conceptual Schema definitions for CS-ACTION of "S", "D", "2", or "M".

Scan CS-QUALIFY list for

```
CSQ-ECNOR = 0
CSQ-AUCR = 0
CSQ-ES-PTR NOT = 0
CSQ-SOURCE = "U"
   or
CSQ-ECNOR = 0
CSQ-AUCR = 0
CSQ-SOURCE = "V"
```

3.1 Generate 01 level for table containing qualify values if entries were found. If language is COBOL, generate:

```
01   CDM-CSQ-TABLE-ccc.
```

Else, generate:

```
CHARACTER*tt  CDM-CSQ-TABLE-ccc
```

where

```
ccc = CS-NDML-NO
ttt = total size of CSQ entries found
```
above

3.2 Generate the following using the same procedure as in above scan. If language is COBOL, generate:

```
03   CSQ-VAR-ccc-ii    PIC clause
```

where

```
ccc    = CS-NDML-NO
ii     = CSQ-INDEX
clause = meta data from current CSQ entry
```
(L)

else perform steps 3.2.1 through 3.2.2.

3.2.1 If CSQ-L-TYPE is equal "C", generate:

```
CHARACTER*11  CSQ-VAR-ccc-nn
```

Else, generate:

```
DOUBLE PRECISION  CSQ-VAR-ccc-nn
CHARACTER*11      XHQcccnn
CHARACTER*ss      CSQ-LONG-VAR-ccc-nn
```

```
where ll  = CSQ-L-SIZE
   ccc = CS-NDML-NO
   nn  = CSQ-INDEX
   ss  = CSQ-L-SIZE + 1
```

3.2.2 Generate additional code:

If ESQ-L-TYPE is equal "C", generate:

```
CHARACTER*ee  ESQ-VAR-ccc-nn
```

Else, generate:

```
DOUBLE PRECISION  ESQ-VAR-ccc-nn
CHARACTER*ee      XQHcccnn
```

```
where  ee  = ESQ-L-SIZE
    ccc = CS-NDML-NO
    nn  = CSQ-ES-PTR
```

3.3 If nothing was generated in step 3.1, generate if COBOL:

```
01    CDM-CSQ-TABLE-ccc    PIC X.
```

Else, generate:

```
CHARACTER*1   CDM-CSQ-TABLE-ccc
```

where

```
ccc = CS-NDML-NO
```

4. Generate External Schema definitions for CS-ACTION of "S", "D", "2", or "M".

Scan CS-QUALIFY list for

```
CSQ-ECNOR = 0
CSQ-AUCR  = 0
CSQ-ES-PTR NOT = 0
 CSQ-SOURCE NOT = "V"
```

For each entry found if language is COBOL generate:

```
01   ESQ-VAR-ccc-nn    PIC clause
```

where

```
      ccc     = CS-NDML-NO
      nn      = CSQ-ES-PTR
clause = meta data in ES-QUALIFY list using CSQ-ES-PTR
             as ESQ-INDEX
```

5. Generate External/Conceptual definitions for CS-ACTION of "I" or "M".

```
Scan CS-ACTION-LIST for
     CS-ES-PTR NOT = 0
     CS-SOURCE NOT = "G"

For each entry found, if COBOL, generate:

      01   ES-VAR-ccc-nn    PIC clause.

where

     ccc        = CS-NDML-NO
     nn         = CS-ES-PTR
     clause     = meta data from ES-ACTION list using
                  CS-ES-PTR as ES-INDEX

      01   CS-VAR-ccc-ii    PIC clause.

where

     ccc    = CS-NDML-NO
     ii     = CS-INDEX
     clause = meta data from CS-ACTION-LIST

else if FORTRAN, perform steps 5.1 through 5.2.

 5.1  If CS-TYPE is equal "C", generate:

              CHARACTER*ll  CS-VAR-ccc-nn

      Else, generate:

              DOUBLE PRECISION  CS-VAR-ccc-nn
              CHARACTER*ll      XHScccnn
              CHARACTER*ss      CS-LONG-VAR-ccc-nn

      where ll  = CS-SIZE
            ccc = CS-NDML-NO
            nn  = CS-INDEX
            ss  = CS-SIZE + 1

5.2  If CS-ACTION not Insert, generate additional code.

        5.2.1  If ES-TYPE is equal "C", generate:

               CHARACTER*ee  ES-VAR-ccc-nn

               Else, generate:

               DOUBLE PRECISION  ES-VAR-ccc-nn

               where ee  = ES-SIZE
                     ccc = CS-NDML-NO
                     nn  = CSQ-ES-PTR
```

34.5 Outputs

1. Error status of the function

   RET-STATUS

2. Code generated into the parcels of the Application Program.

```
     ccc        = CS-NDML-NO
     nn         = CS-ES-PTR
     clause     = meta data from ES-ACTION list using
                  CS-ES-PTR as ES-INDEX

      01   CS-VAR-ccc-ii    PIC clause.
```

where

```
     ccc    = CS-NDML-NO
     ii     = CS-INDEX
     clause = meta data from CS-ACTION-LIST
```

else if FORTRAN, perform steps 5.1 through 5.2.

5.1 If CS-TYPE is equal "C", generate:

```
        CHARACTER*ll  CS-VAR-ccc-nn
```

Else, generate:

```
        DOUBLE PRECISION  CS-VAR-ccc-nn
        CHARACTER*ll      XHScccnn
        CHARACTER*ss      CS-LONG-VAR-ccc-nn
```

```
where ll  = CS-SIZE
      ccc = CS-NDML-NO
      nn  = CS-INDEX
      ss  = CS-SIZE + 1
```

5.2 If CS-ACTION not Insert, generate additional code.

5.2.1 If ES-TYPE is equal "C", generate:

```
CHARACTER*ee  ES-VAR-ccc-nn
```

Else, generate:

```
DOUBLE PRECISION  ES-VAR-ccc-nn
```

```
where ee  = ES-SIZE
      ccc = CS-NDML-NO
      nn  = CSQ-ES-PTR
```

34.5 Outputs

1. Error status of the function

   RET-STATUS

2. Code generated into the parcels of the Application Program.

SECTION 35

FUNCTION CDUEMV Generate "MOVE" statements for runtime update/ search values.

This function will:

1. Generate MOVE statements for insert, modify and qualify values from user defined variables or constants to External Schema format data definitions.

2. Code will be generated in the Procedure Division of the modified AP to move the user defined variable value or constant to External Schema format data definitions. Depending on CS-ACTION-TYPE the following code will be generated:

```
           {var
     MOVE   value          TO       {ES-VAR-cc-nn
           `constant'}                     ESQ-VAR-ccc-nn}
```

NOTE: If the user's application program is written in FORTRAN, then as of release 2.3, all FORTRAN variable names will be generated with a length of six. This will be done by generating names of the convention: CDMXXX where XXX is any combination of three characters. The three character combination is determined by routine CDCREFO. This routine associates a six character FORTRAN variable with the corresponding COBOL variable. This association between the COBOL name and the generated FORTRAN name is stored in the FORTRAN-VARIABLE-TABLE. The FORTRAN-VARIABLE-TABLE is copied into modified user's application program. In this design specification, the COBOL name will be used to show how the FORTRAN code will be generated.

35.1 Inputs

1. External Schema representation of the data

   ES-ACTION-LIST
   ES-QUALIFY-LIST

2. Conceptual Schema representation of the data

   CS-ACTION-LIST
   CS-QUALIFY-LIST

3. Application Program parcel names

   PROC-FILE-NAME

4. Source Language Indicator of the Application Program

LANG-NO

5. Fortran Variable Association Table

FORTRAN-VARIABLE-TABLE

35.2 CDM Requirements

None

35.3 Internal Requirements

None

35.4 Processing

1. Generate "MOVE" statements for CS-ACTION of "1" or "K".

   Scan CS-QUALIFY-LIST for

   ```
   CSQ-ECNOR = 0
   CSQ-AUCR = 0
   CSQ-ES-PTR   NOT = 0
   ```

   Generate the following code for each entry:

   1.1 If COBOL, generate the "Move" statement:

   ```
           {var
   MOVE  value          TO       ES-VAR-ccc-nn.
         `constant'}
   ```

   where

   ```
   ccc = CS-NDML-NO
   nn  = CSQ-ES-PTR
   ```

   var, value, constant is determined from ES-LOCAL-VARIABLE, ES-SUBSCRIPT or ES-VALUE in ES-ACTION-LIST using CSQ-ES-PTR as ES-INDEX

   If FORTRAN, generate the assign statement:

   ```
   ES-VAR-ccc-nn = {var,
                    value,
                    'constant'}
   ```

   where

   ```
   ccc = CS-NDML-NO
   nn  = CSQ-ES-PTR
   ```

   var, value, constant is determined from ES-LOCAL-VARIABLE, ES-SUBSCRIPT or ES-VALUE in ES-ACTION-LIST

2. Generate "MOVE" statements for select, delete or modify values (CS-ACTION = "S", "D", "M" or "2").

```
2.1  Scan CS-QUALIFY-LIST for
          CSQ-ECNOR    = 0
          CSQ-AUCR     = 0
          CSQ-SOURCE   = "V"
          CSQ-OP NOT   = "NN" or "NL"

     If COBOL, generate the statement:

          MOVE "CV" to CSQ-VAR-cc-ii
        where cv = CSQ-VARY1
               cc = CS-NDML-NO
               ii = CSQ-INDEX

     If FORTRAN, generate the statement:

          CSQ-VAR-cc-ii = 'CV'
          where cv = CSQ-VARY1
               cc = CS-NDML-NO
               ii = CSQ-INDEX

2.2  Scan CS-QUALIFY-LIST for

     CSQ-ECNOR        = 0
     CSQ-AUCR         = 0
     CSQ-ES-PTR   NOT = 0

     If COBOL, generate the "MOVE" statement

           {var
     MOVE  value            TO      ESQ-VAR-ccc-nn
             `constant'}

     where

          ccc = CS-NDML-NO
          nn  = CSQ-ES-PTR

        var, value, constant is determined from
        ES-LOCAL-VARIABLE, ES-SUBSCRIPT OR ES-VALUE
        in ES-ACTION-LIST

        ES-INDEX = CS-ES-PTR

     If FORTRAN, generate the assign statement:

          ESQ-VAR-ccc-nn = {var,
                            value,
                            'constant'}

     where

          ccc = CS-NDML-NO
          nn  = CSQ-ES-PTR

     var, value, constant is determilned from
     ES-LOCAL-VARIABLE, ES-SUBSCRIPT or ES-VALUE in
     ES-ACTION-LIST
```

3. Generate "MOVE" statements for modify values (CS-ACTION = "M").

   Scan CS-ACTION-LIST for

   ```
   CS-ES-PTR NOT = 0
   CS-SOURCE NOT = G
   ```

   3.1 If COBOL, generate the "MOVE" statement.

   ```
     {var
   MOVE  value          TO      ES-VAR-ccc-nn
     `constant'}
   ```

   where

   ```
   ccc = CS-NDML-NO
   nn  = CSQ-ES-PTR
   ```

   var, value, constant is determined from ES-LOCAL-VARIABLE, ES-SUBSCRIPT or ES-VALUE in ES-ACTION-LIST using CS-ES-PTR as ES-INDEX

   If FORTRAN, generate the assign statement:

   ```
   ES-VAR-ccc-nn = {var
                    value
                    'constant'}
   ```

   ```
   where ccc = CS-NDML-NO
          nn  = CSQ-ES-PTR
   ```

   var, value, constant is determined from ES-LOCAL-VARIABLE, ES-SUBSCRIPT or ES-VALUE in ES-ACTION-LIST

35.5 Outputs

1. Error status of the function

   RET-STATUS

2. Code generated into the parcels of the Application Program.

SECTION 36

FUNCTION CDP10S - Perform Query Combination

This function will:

1. Generate code into the procedure parcel of the application program that is used to assemble the input parameters required for the appropriate aggregator to satisfy an NDML query combination command.
2. Generate code into the working storage parcel of the application program to be used as input parameters for the aggregator calls.
3. Generate code into the procedure parcel of the application program to call the appropriate aggregator module to satisfy an NDML Query Combination command.

NOTE: If the user's application program is written in FORTRAN, then as of release 2.3, all FORTRAN variable names will be generated with a length of six. This will be done by generating names of the convention: CDMXXX where XXX is any combination of three characters. The three character combination is determined by routine CDCREFO. This routine associates a six character FORTRAN variable with the corresponding COBOL variable. This association between the COBOL name and the generated FORTRAN name is stored in the FORTRAN-VARIABLE-TABLE. The FORTRAN-VARIABLE-TABLE is copied into modified user's application program. In this design specification, the COBOL name will be used to show how the FORTRAN code will be generated.

36.1 Inputs

1. Query Combination Type

   The NDML Query Combination operator:

   J-INTERSECT
   D-DIFFERENCE

```
          U-UNION

          01    QUERY-TYPE    PIC X.

    2. ES-NDML Identifier for first Results

          01   ES-NDML-ID1    PIC X(4).

3.    CS-NDML Identifier for first Results

          01   CS-NDML-ID1    PIC X(6).

4.    ES-NDML Identifier for second Results

          01   ES-NDML-ID2    PIC X(4).

5.    CS-NDML Identifier for second Results

          01   CS-NDML-ID2    PIC X(6).

6.    Working Storage Work File Name

          01   WORK-FILE1    PIC X(30).

7.    Procedure Division Work File Name

          01   WORK-FILE2    PIC X(30).

8.    Source Language Indicator of the Application Program

          01   LANG-NAME     PIC X(10).

9.   Conceptual Schema Action List

          CS-ACTION-LIST

10. Result Field Table

          RFT

11. Join Query Graph Attribute Pair List

          JQG-ATTRIBUTE-PAIR-LIST

12. Fortran Variable Association Table
```

FORTRAN-VARIABLE-TABLE

13. Target Host Name PIC XXX.

TARGET-HOST

36.2 CDM Requirements

None

36.3 Internal Requirements

1. Next Identifier Counters

```
01    NEXT-ID-CTR     PIC 9(3).

01    NEXT-ID-CTR1    PIC 9(5).
```

36.4 Processing

1. Generate working storage variables required for the Query Combination.

   1.1 Increment the next identifier counters for Query Combination.

   1.2 Construct the external NEXT-QRY-ID variable using the constant "Q" and NEXT-ID-CTR.

   Construct the conceptual NEXT-QRY-ID variable using the constant "Q" and NEXT-ID-CTR1.

   1.3 Generate working storage variables to hold name of the results file and the result count for the Query Combination. If language is COBOL, generate:

```
01    CDM-CS-RESULTS-xxxx     PIC X(80).
01    CDM-CS-COUNT-xxxx       PIC 9(6).
```

   else, generate:

```
CHARACTER*80  CDM-CS-RESULTS-xxxx
CHARACTER*6   CDM-CS-COUNT-xxxx
```

where

```
xxxx = NEXT-CS-QRY-ID
```

1.4 Generate copy statements to include the Attribute Pair List for the aggregation process. If language is COBOL, generate:

```
COPY APL OF IISSCLIB REPLACING
==JQG-ATTRIBUTE-PAIR-LIST==BY
==CDM-APL-xxxx==
```

else, generate:

```
CHARACTER*tt          CDM-APL-xxxx
DATA CDM-APL-xxxx     /'rr0022'/
```

where

```
tt   = APL-ENTRY * number non-deleted CS
       entries + APL-HEAD
xxxx = NEXT-CS-QRY-ID
rr   = actual number of non-deleted CS
        entries.
```

1.5 Generate copy statements to include the Conceptual Schema Action Table and the Result Field Table for the aggregation process.

Generate if COBOL:

```
COPY CSAL OF IISSCLIB REPLACING
==CS-ACTION-LIST==BY
==CDM-CSAL-xxxx-cccc==

COPY RFTABLE OF IISSCLIB REPLACING
==01 RFT== BY
==01 CDM-RFT-xxxx-cccc==.
```

else, generate:

```
If CS-USED > 0

CHARACTER*tt       CDM-CSAL-xxxx-cccc
DATA CDM-CSAL-xxxx-cccc  /'uu'/
```

```
else,

CHARACTER*4         CDM-CSAL-xxxx-cccc
                          /'0000'/

If RFT-USED > 0

CHARACTER**ee        CDM-RFT-xxxx-cccc
DATA CDM-RFT-xxxx-cccc    /'ff000024'/

else,

CHARACTER*6          CDM-RFT-xxxx-cccc
DATA CDM-RFT-xxxx-cccc    /'000000'/

where

tt   = CS-ENTRY * CS-USED + CS-HEAD
uu   = CS-USED
xxxx = NEXT-QRY-ID
cccc = NEXT-CS-QRY-ID
ee   = RFT-ROW * RFT-USED + RFT-HEAD
ff   = RFT-USED
```

2. Generate procedure division code to satisfy the NDML Query Combination command.

   2.1 Generate code to populate the Result Field Table, Conceptual Schema Action List and the Attribute Pair List required for the aggregation process.

      2.1.1 If COBOL, call "CDMACR" utility with the following:

```
 Library Name - COBOL
 Macro Name   - RFTBUILD
 Parameters
   P1 = ES-NDML-ID1
   P2 = CS-NDML-ID1
   P3 = ES-NDML-ID2
   P4 = CS-NDML-ID2
   P5 = NEXT-QRY-ID
   P6 = NEXT-CS-QRY-ID
File Name = WORK-FILE2
```

else, generate FORTRAN code to

correspond to COBOL RFTBUILD MACRO.

2.2 Generate code to call the appropriate aggregator to perform the Query Combination:

2.2.1 If Query Combination Type = "I", call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - J01CALL
Parameters
  P1 = ES-NDML-ID1
  P2 = ES-NDML-ID2
  P3 = NEXT-CS-QRY-ID
  P4 = CS-NDML-ID1
  P5 = CS-NDML-ID2
File Name = WORK-FILE2

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - J01CALL
Parameters
  P1 = CDM-CS-RESULTS-cc1
  P2 = CDM-CS-RESULTS-cc2
  P3 = CDM-APL-cq
  P4 = CDM-RFT-ee1-cc1
  P5 = CDM-RFT-ee2-cc2
  P6 = CDM-CS-COUNT-cq
  P7 = CDM-CS-RESULTS-cq

where cc1 = CS-NDML-ID1
      cc2 = CS-NDML-ID2
      ee1 = ES-NDML-ID1
      ee2 = ES-NDML-ID2
      cq = NEXT-CS-QRY-ID
```

2.2.2 If Query Combination Type = "U", call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - U01CALL
Parameters
   P1 = CS-NDML-ID1
   P2 = CS-NDML-ID2
   P3 = NEXT-CS-QRY-ID
   P4 = ES-NDML-ID1

Library Name - VAXFORTRAN or IBMFORTRAN
```

```
            Macro Name - U01CALL
            Parameters
               P1 = CDM-CS-RESULTS-cc1
               P2 = CDM-CS-RESULTS-cc2
               P3 = CDM-CS-RESULTS-cq
               P4 = CDM-RFT-ee1-cc1

            where cc1 = CS-NDML-ID1
                  cc2 = CS-NDML-ID2
                  cq  = NEXT-CS-QUERY-ID
```

2.2.3 If Query Combination Type = "D", call "CDMACR" utility with the following:

```
           Library Name - COBOL
           Macro Name - N01CALL
           Parameters
              P1 = ES-NDML-ID1
              P2 = ES-NDML-ID2
              P3 = NEXT-CS-QRY-ID
              P4 = CS-NDML-ID1
              P5 = CS-NDML-ID2

           Library Name - VAXFORTRAN or IBMFORTRAN
           Macro Name - N01CALL
           Parameters
              P1 = CDM-CS-RESULTS-cc1
              P2 = CDM-CS-RESULTS-cc2
              P3 = CDM-APL-cq
              P4 = CDM-RFT-ee1-cc1
              P5 = CDM-RFT-ee2-cc2
              P6 = CDM-CS-COUNT-cq
              P7 = CDM-CS-RESULTS-cq

           where cc1 = CS-NDML-ID1
                 cc2 = CS-NDML-ID2
                 ee1 = ES-NDML-ID1
                 ee2 = ES-NDML-ID2
                 cq = NEXT-CS-QRY-ID
```

2.3 Generate a closing label for the Query Combination. If COBOL, generate:

```
        END-NDML-xxxx.
```

else, generate:

```
          99ii CONTINUE

     where

          xxxx = NEXT-QRY-ID
          ii   = NEXT-ID-CTR
```

36.5 Outputs

1. Next External Identifier for Query Combination results.

```
01    NEXT-QRY-ID    PIC X(4)
```

2. Next Conceptual Identifier for Query Combination results file.

```
01    NEXT-CS-QRY-ID PIC X(6)
```

3. Return Status

```
01    RET-STATUS     PIC X(5)
```

CDP10S MACROS

Library Name - COBOL

Macro Name - J01CALL

```
Parameters - P1
             P2
             P3
             P4
             P5

*
*    Call the Join aggregator to Perform the Intersect
*

     CALL "CDJS1" USING
                  CDM-CS-RESULTS-P4
                  CDM-CS-RESULTS-P5
                  CDM-APL-P3
                  CDM-RFT-P1-P4
                  CDM-RFT-P2-P5
                  CDM-RFT-P1-P4
*
                  CDM-CS-COUNT-P3
                  CDM-CS-RESULTS-P3
                  NDML-STATUS.
```

```
Library name - COBOL

Macro Name - U01CALL

Parameters - P1
             P2
             P3
             P4

*
*    Call the Union Aggregator to Perform the UNION.

     CALL "CDUS1" USING
                  CDM-CS-RESULTS-P1
                  CDM-CS-RESULTS-P2
                  CDM-CS-RESULTS-P3
                  CDM-RFT-P4-P1
                  NDML-STATUS.
```

```
Library Name - COBOL

Macro Name - N01CALL

Parameters - P1
             P2
             P3
             P4
             P5

*
*    Call the Not In Set Aggregator to Perform the Difference

     CALL "CDNS1" USING
                  CDM-CS-RESULTS-P4
                  CDM-CS-RESULTS-P5
                  CDM-APL-P3
                  CDM-RFT-P1-P4
                  CDM-RFT-P2-P5
*
                  CDM-CS-COUNT-P3
                  CDM-CS-RESULTS-P3
                  NDML-STATUS.
```

```
Library Name - COBOL

Macro Name   - RFTBUILD

Parameters - P1
             P2
             P3
             P4
             P5
             P6

     MOVE 0 TO NDML-CS-COUNT.
     MOVE 0 TO NDML-RFT-COUNT.
NDML-TEMP-LOOP-P5.
     ADD 1 TO NDML-CS-COUNT.
     IF NDML-CS-COUNT > CS-USED OF CDM-CSAL-P1-P2
      MOVE NDML-RFT-COUNT TO CS-USED OF CDM-CSAL-P5-P6
                             RFT-USED OF CDM-RFT-P1-P2
                             APL-USED OF CDM-APL-P6
      MOVE 0 TO NDML-CS-COUNT
      MOVE 0 TO NDML-RFT-COUNT
      GO TO NDML-LOOPL-END-P5.
     IF NOT-CS-DELETED OF CDM-CSAL-P1-P2 (NDML-CS-COUNT)
      ADD 1 TO NDML-RFT-COUNT
      MOVE CS-AUC  OF CDM-CSAL-P1-P2 (NDML-CS-COUNT) TO
         RFT-ATTR  OF CDM-RFT-P1-P2 (NDML-RFT-COUNT)
         JQG-ATTRL OF CDM-APL-P6 (NDML-RFT-COUNT)
         CS-AUC    OF CDM-CSAL-P5-P6 (NDML-RFT-COUNT)
      MOVE CS-TYPE OF CDM-CSAL-P1-P2 (NDML-CS-COUNT) TO
         RFT-TYPE  OF CDM-RFT-P1-P2 (NDML-RFT-COUNT)
         CS-TYPE   OF CDM-CSAL-P5-P6 (NDML-RFT-COUNT)
      MOVE CS-SIZE OF CDM-CSAL-P1-P2 (NDML-CS-COUNT) TO
         RFT-SIZE  OF CDM-RFT-P1-P2 (NDML-RFT-COUNT)
         CS-SIZE   OF CSM-CSAL-P5-P6 (NDML-RFT-COUNT)
      MOVE "= " TO JQG-OP OF CDM-APL-P6 (NDML-RFT-COUNT)
      MOVE 1 TO
         JQG-SUBTRANSL OF CDM-APL-P6 (NDML-RFT-COUNT)
         RFT-SUBTRANS OF CDM-RFT-P1-P2 (NDML-RFT-COUNT)
      MOVE CS-ND   OF CDM-CSAL-P1-P2 (NDML-CS-COUNT) TO
         RFT-ND    OF CDM-RFT-P1-P2 (NDML-RFT-COUNT)
         CS-ND     OF CDM-CSAL-P5-P6 (NDML-RFT-COUNT).
     GO TO NDML-TEMP-LOOPL-P5.
NDML-LOOPL-END-P5.
NDML-TEMP-LOOPR-P5.
     ADD 1 TO NDML-CS-COUNT.
     IF NDML-TEMP-COUNT > CS-USED OF CDM-CSAL-P3-P4
         MOVE NDML-RFT-COUNT TO RFT-USED OF CDM-RFT-P3-P4
         MOVE 0 TO NDML-CS-COUNT
         MOVE 0 TO NDML-RFT-COUNT
         GO TO NDML-LOOPR-END-P5.
     IF NOT-CS-DELETED OF CDM-CSAL-P3-P4 (NDML-CS-COUNT)
         ADD 1 TO NDML-RFT-COUNT
         MOVE CS-AUC OF CDM-CSAL-P3-P4 (NDML-CS-COUNT) TO
            RFT-ATTR OF CDM-RFT-P3-P4 (NDML-RFT-COUNT)
            JQG-ATTRR OF CDM-APL-P6 (NDML-RFT-COUNT)
         MOVE CS-TYPE OF CDM-CSAL-P3-P4 (NDML-CS-COUNT) TO
            RFT-TYPE  OF CDM-RFT-P3-P4 (NDML-RFT-COUNT)
         MOVE CS-SIZE OF CDM-CSAL-P3-P4 (NDML-CS-COUNT) TO
            RFT-SIZE  OF CDM-RFT-P3-P4 (NDML-RFT-COUNT)
         MOVE 2 TO
            JQG-SUBTRANSR OF CDM-APL-P6 (NDML-RFT-COUNT)
            RFT-SUBTRANS OF CDM-RFT-P3-P4 (NDML-RFT-COUNT)
         MOVE CS-ND   OF CDM-CSAL-P3-P4 (NDML-CS-COUNT) TO
            RFT-ND    OF CDM-RFT-P3-P4 (NDML-RFT-COUNT).
     GO TO NDML-TEMP-LOOPR-P5.
NDML-LOOPR-END-P5.
```

LIBRARY NAME - FORTRAN

MACRO NAME - J01CALL

```
PARAMETERS - P1
             P2
             P3
             P4
             P5
             P6
             P7
```

```
      CALL CDJS1( %REF(P1), %REF(P2), %REF(P3)
     *          , %REF(P4), %REF(P5)
     *          , %REF(P6)
     *          , %REF(P7), %REF(NDMLST))
     *
```

```
LIBRARY NAME - FORTRAN

MACRO NAME - N01CALL

PARAMETERS - P1
             P2
             P3
             P4
             P5
             P6
             P7


      CALL CDNS1( %REF(P1), %REF(P2), %REF(P3)
     *          , %REF(P4), %REF(P5)
     *          , %REF(P6)
     *          , %REF(P7), %REF(NDMLST))
```

LIBRARY NAME - FORTRAN

MACRO NAME - U01CALL

```
PARAMETERS - P1
             P2
             P3
             P4

      CALL CDUS1( %REF(P1), %REF(P2)
     *          , %REF(P3)
     *          , %REF(P1), %REF(NDMLST))
```

SECTION 37

FUNCTION CDP10T - Generate code to perform final mapping of results from Query Combination Command.

This function will:

1. Generate code into the working storage parcel of the Application Program to be used for the final mapping of results from a Query Combination command.

2. Generate code into the procedure parcel of the Application Program to call the C/E Transform Program and map the results into user specified variables, structure or file.

NOTE: If the user's application program is written in FORTRAN, then as of release 2.3, all FORTRAN variable names will be generated with a length of six. This will be done by generating names of the convention: CDMXXX where XXX is any combination of three characters. The three character combination is determined by routine CDCREFO. This routine associates a six character FORTRAN variable with the corresponding COBOL variable. This association between the COBOL name and the generated FORTRAN name is stored in the FORTRAN-VARIABLE-TABLE. The FORTRAN-VARIABLE-TABLE is copied into modified user's application program. In this design specification, the COBOL name will be used to show how the FORTRAN code will be generated.

37.1 Inputs

1. External Schema representation of the Data

```
ES-ACTION-LIST    (mapping SELECT)
ES-ACTION-LIST    (inner SELECT)
```

2. Conceptual Schema representation of the Data

```
CS-ACTION-LIST    (inner SELECT)
```

3. Code Generation Table

```
CODE-GENERATOR-TABLE
```

4. Application Program Parcel Names

```
IDFILE-NAME       PIC X(30)
FDFILE-NAME
WORKFILE-NAME
PROCFILE-NAME
```

5. Application Program Error File Name

   ERROR-FILE PIC X(30)

6. Source Language Indicator of the Application Program

   SOURCE-LANGUAGE

7. Input-Output Section Indicator

   IOSECTION-INDICATOR

8. Host Information about the Application

   TARGET-HOST PIC X(3)
   CURRENT-HOST PIC X(3)

9. Block Stack

   BLOCK-STACK

10. Next Conceptual Schema Query Identification Number

    NEXT-CS-QRY-ID PIC X(6)

11. Action Symbol

    ACTION-SYMBOL PIC X

12. Fortran Variable Association Table

    FORTRAN VARIABLE TABLE

37.2 CDM Requirements

None

37.3 Internal Requirements

```
01     MOD-NAME        PIC X(10).
01     CE-EMPTY        PIC 9999     VALUE 0.
01     BOOL-EMPTY      PIC 9999     VALUE 0.
01     CSQ-EMPTY       PIC 9999     VALUE 0.
01     CMA-FLAG        PIC 9        VALUE 0.
01     DBMS-NAME       PIC X(30).
01     GEN-FILE-NAME   PIC X(30).
01     NEXT-QRY-ID     PIC X.
```

37.4 Processing

1. Obtain a program name for the Conceptual/External Transformation Program. Call routine "APNAME" with the following parameters to obtain a program name:

DBMS-NAME	- variable containing value of spaces
MOD-NAME	- output parameter containing a new program name
RET-STATUS	- returned status of function APNAME

1.1 If ES-SEMI-CURLY-IND of mapping (outer) SELECT, add another entry to the BLOCK-STACK.

Add 1 to BLOCK-INDEX
Set MOD-NAME-STACK to MOD-NAME
Set CS-NDML-NO-STACK to CS-NAME-NO

2. Determine if the number of result fields requested on the outer select, match those requested on the inner selects.

2.1 If ES-FILE-NAME or ES-STRUCTURE does not equal space, continue at step 3.

2.2 Count the number of projected columns of ES-ACTION-INNER. If this number does not equal ES-USED of ES-ACTION-LIST, generate an error message, set the status variable and exit.

3. Combine the ES-ACTION List of the inner selects with the ES-ACTION List of the outer (mapping) select.

3.1 For each used entry in the Inner ES-ACTION List, transfer the type, size and number of decimal digits to the corresponding entry in the mapping ES-ACTION List.

ES-TYPE
ES-SIZE
ES-ND
ES-PROJECT-FLAG
ES-DELETE-FLAG

4. Generate a Conceptual/External Schema Transformation Program for the final results of the Query Combination command.

4.1 Call function CDPRE8 with the following parameters:

TARGET-HOST	input parameter
CURRENT-HOST	input parameter
MOD-NAME	name of program obtained in step 1
ES-ACTION-LIST	combined action list from step 3
CS-ACTION-LIST	input parameter (modified to not include generated entries)
BOOL-EMPTY	indicates no entries in BOOLEAN list
CSQ-EMPTY	indicates no entries in the CS-QUALIFY list
ISQ-EMPTY	indicates no entries in the IS-QUALIFY LIST
ERROR-FILE	input parameter
CMA-FLAG	indicates no complex mapping

	transformation
GEN-FILE-NAME	returned file name of file containing the Generated C/E Transform Program
LANG-NO	indicates what language the user's AP was written in.
RET-STATUS	returned status of function CDPRE8

4.2 Store the file name of the Generated C/E Transform Program in the Code Generation Table.

5. Generate working storage variables required for processing the final results.

5.1 Generate working storage variables to hold the name of the file containing the final conceptual results and table for qualify variables. If language is COBOL, generate:

```
01    CDM-CSQ-TABLE-eee          PIC X.
```

Else, generate:

```
CHARACTER*1   CDM-CSQ-TABLE-eee
```

where

eee = ES-NDML-NO

5.2 Generate file layout structure or local variables for the final results.

5.2.1 If ES-FILE-NAME equals space, continue at step 5.2.2.

5.2.1.1 Generate variable containing file name in WS parcel. If language is COBOL, generate:

```
01   CDM-RESULTS-NAME-eee   PIC X(80).
01   CDM-RESULTS-REC-eee.
```

Else, generate:

```
CHARACTER*80  CDM-RESULTS-NAME-eee
```

where

eee = ES-NDML-NO

Continue at step 5.2.3.

5.2.2. Generate working storage for the results first 01 level. If language is COBOL, generate:

```
01    CDM-RESULTS-eee.
```

where

eee = ES-NDML-NO

5.2.3 Generate variables to hold results

Call function CDP10F with the following parameters:

```
LANG-NO
CS-ACTION-LIST
ES-ACTION-LIST
FDFILE-NAME
WORKFILE-NAME
FORTRAN-VARIABLE-TABLE
RET-STATUS
```

6. Generate code to move the results file name of last combination operation to results file name of current SELECT. If language is COBOL, generate:

```
MOVE   CDM-CS-RESULTS-xxxx    TO
CDM-CS-RESULTS-FILE-eee.
```

Else, generate:

```
CDM-CS-RESULTS-FILE-eee = CDM-CS-RESULTS-xxxx
```

where

```
eee  = ES-NDML-NO
xxxx = NEXT-CS-QRY-ID
```

7. Generate status checking and record count determination from last combination operator and initialization of NDML-COUNT for retrieval loop. If language is COBOL, generate:

```
     MOVE ZERO TO NDML-COUNT.

IF NOT OK
        GO TO END-NDML-eee.
```

If ACTION-SYMBOL NOT = "U" generate:

```
     IF CDM-CS-COUNT-xxxx = 0
        GO TO END-NDML-eee.
```

Else, generate:

```
     NDMLCT = 0
IF (NDMLST.NE. '00000') Go to 93eee
```

If ACTION-SYMBOL NOT = "U" generate:

```
IF (CDM-CS-COUNT-xxxx .EQ. '000000') Go to 93eee
```

where

```
     eee = ES-NDML-NO
    xxxx = NEXT-CS-QRY-ID
```

8. Generate code to call the C/E Transform Program for the first time.

   8.1 Call "CDMACR" utility with the following:

```
        Library Name - COBOL
        Macro Name - CECALL
           Parameters
              P1    = 1
              EE    = ES-NDML-NO
              MMMMM = program name from step 4.1
              CC    = ES-NDML-NO

           Library Name - VAXFORTRAN or IBMFORTRAN
           Macro Name - CECALL
           Parameters
             P1    = '1'
             P2    = CDM-CS-RESULTS-FILE-ee
             P3    = CDM-CSQ-TABLE-ee
             P4    = CDM-RESULTS-ee
             MMMMM = program name from step 4.1

           where ee = ES-NDML-NO
```

   8.2 If language is COBOL, generate:

```
         IF NOT CDM-CE-EOF
                ADD 1 TO NDML-COUNT
```

   Else, generate:

```
         IF (EOFFLA .NE. '1') NDMLCT = NDMLCT+1
```

   8.3 Call "CDMACR" utility with the following:

```
           Library Name - COBOL or VAXFORTRAN or
                               IBMFORTRAN
           Macro Name - ERRCHKCE
           Parameters
              EE = ES-NDML-NO
```

9. Generate code to move the values in the result record to the named variables, structure or file.

   9.1 If ES-FILE-NAME not equal space continue at step 9.2 else if COBOL generate:

```
              LOOP-eee.
```

   Else, generate:

```
         94eee  CONTINUE
```

where

```
    eee = ES-NDML-NO
```

9.2 Call function "CDP10C" to generate the moves with the following parameters:

```
    LANG-NO
    PROCFILE-NAME
    ES-ACTION-LIST
    CS-NDML-NO
    FORTRAN-VARIABLE-TABLE
    RET-STATUS
```

10. Generate code to close and delete the results file and terminate the loop structure for SELECT into variables or structure that did not have an NDML loop structure.

If ES-FILE-NAME not equal space continue at step 11. If ES-SEMI-CURLY-IND equal spaces generate code to call the C/E Transform Program to close and delete the results file. Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - CECALL
Parameters
   P1    = 3
   EE    = ES-NDML-NO
   MMMMM = program name from step 4.1
   CC    = ES-NDML-NO

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - CECALL
Parameters
  P1    = '3'
  P2    = CDM-CS-RESULTS-FILE-ee
  P3    = CDM-CSQ-TABLE-ee
  P4    = CDM-RESULTS-ee
  MMMMM = program name from step 4.1
```

where ee = ES-NDML-NO

If ES-SEMI-CURLY-IND equal space generate closing loop structure.

Generate if COBOL:

```
       .
       END-NDML-eee.
```

Else, generate:

```
       93eee  CONTINUE
```

where

```
       eee = ES-NDML-NO
```

Continue processing at step 12.

11. Generate code to save results to a users file.

11.1 Generate code to begin saving results into users file.

Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - FILSAV1
Parameters
   EE = ES-NDML-NO
   F1 = ES-FILE-NAME (variable or constant)

Library Name - VAXFORTRAN or IBMFORTRAN
Macro name - FILSAV1
Parameters
   EE = ES-NDML-NO
   F1 = 'ES-FILE-NAME'
   P1 = CDM-RESULTS-NAME-ee
   P2 = FCB-CDM-RESULTS-ee
   P3 = CDM-RECORD-LENGTH-ee
```

11.2 Generate paragraph name for program loop of saving results to a file.

Generate if COBOL:

```
LOOP-eee.
```

where

```
eee = ES-NDML-NO
```

11.3 Generate code to save the null flag values for the retrieved data.

For each projected data item in the ES-ACTION-LIST, generate if COBOL:

```
MOVE FLAG-X(ii)    TO ES-NULL-cc-nn.
```

where

```
ii = current index into the null flag array
cc = CS-NDML-NO
nn = ES-INDEX
```

Else, calculate the sum of the number of non-deleted ES entries.

Generate:

```
CDM-RESULTS-REC-ee(1:rr)  = FLAGAR(1:rr)
```

```
where ee = ES-NDML-NO
      rr = REAL-CS-USED
```

11.4 Generate code to save the retrieved data:

11.4.1 If COBOL, generate:

```
MOVE CDM-RESULTS-ee to
CDM-RESULTS-RECORD-ee

where ee = ES-NDML-NO
```

11.4.2 If FORTRAN, perform steps 11.4.2.1 through 11.4.2.5 for each projected data item in the ES-ACTION-LIST. Initialize START-POS to 1 and START-POSF to REAL-ES-USED plus 1.

11.4.2.1 If ES-FCTN-NAME is "COUNT," perform steps 11.4.2.1.1 through 11.4.2.1.3.

11.4.2.1.1 Set END-POS equal START-POS + 8. Set END-POSF equal START-POSF + 8.

11.4.2.1.2 Generate:

```
  Call CONDIG
 (CDM-RESULTS-ee(ep:ep),
    SIGN,DIGIT,NDMLST)
CDM-RESULTS-REC-ee(sf:ef) =
  CDM-RESULTS-ee(sp:ep)
 where ee = ES-NDML-NO
       ep = END-POS
       sp = START-POS
       ef = END-POSF
       sf = START-POSF
```

11.4.2.1.3 Set START-POS equal END-POS plus 1. Set START-POSF equal END-POSF plus 1. Continue at step 4.2.12.2.

11.4.2.2 If ES-FCTN-NAME is equal to "MEAN," or "AVG," or "SUM," perform steps 11.4.2.2.1 through 11.4.2.2.3.

11.4.2.2.1 Set START-POS equal START-POS plus 8. Set END-POSF = START-POSF plus 18.

11.4.2.2.2 Generate:

```
DECIML = 9
CALL RELFTN(DECIML,ES-RES-cc-ii,
         LONG-ES-RES-cc-ii,
CDM-RESULTS-REC-ee
                  (sf:ef))
where cc = CS-NDML-NO
      ii = ES-INDEX
      sf = START-POSF
      ef = END-POSF
      ee = ES-NDML-NO
```

11.4.2.2.3 Set START-POSF equal END-POSF plus 1. Continue at step 11.4.2.

11.4.2.3 If ES-TYPE equals "I", perform steps 11.4.2.3.1 through 11.4.2.3.3.

11.4.2.3.1 Set END-POSF equal START-POSF plus 9.

11.4.2.3.2 Generate:

```
DIGIT = ES-RES-cc-ii
CALL
INTFTN(DIGIT,CDM-RESULTS-RE
C- (sf:ef))
where cc = CS-NDML-NO
      ii = ES-INDEX
      ee = ES-NDML-NO
      sf = START-POSF
      ef = END-POSF
```

11.4.2.3.3 Set START-POSF equal END-POSF plus 1.
If ES-SIZE is greater than 4
Set START-POS equal START-POS plus 4.
Else
Set START-POS equal START-POS plus 2.
Continue at step 11.4.2.

11.4.2.4 If ES-TYPE equals "F", same processing as step 11.4.2.2.

11.4.2.5 If ES-TYPE equals "C", perform steps 11.4.2.5.1 through 11.4.2.5.3.

11.4.2.5.1 Set END-POSF equal START-POSF plus ES-SIZE minus 1.
Set END-POS equal START-POS plus ES-SIZE minus 1.

11.4.2.5.2 Generate:

```
                        CDM-RESULTS-REC-ee(sf:ef) =
                        CDM-RESULTS-ee(sp:ep)
                        where ee = ES-NDML-NO
                              sf = START-POSF
                              ef = END-POSF
                              sp = START-POS
                              ep = END-POS

            11.4.2.5.3  Set START-POS equal END-POS
                        plus 1.
                        Set START-POSF equal
                        END-POSF plus 1.
                        Continue at step 11.4.2.
```

11.5 Generate code to write the results to the user specified file.

Call "CDMACR" utility with the following:

```
  Library Name - COBOL
  Macrro Name  - UAPWR
  Parameters
     EE = ES-NDML-NO

  Library Name - VAXFORTRAN or IBMFORTRAN
  Macro Name - UAPWR
  Parameters
    EE = ES-NDML-NO
    P1 = FCB-CDM-RESULTS-ee
    P2 = CDM-RESULTS-REC-ee
    P3 = CDM-RECORD-LENGTH-ee

  where ee = ES-NDML-NO
```

11.6 Generate code to call the C/E Transform Program for the 2-N time.

11.6.1 Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - CECALL
Parameters
   P1    = 2
   EE    = ES-NDML-NO
   MMMMM = program name from step 4.1
   CC    = ES-NDML-NO

Library Name - VAXFORTRAN or IBMFORTRAN
Macro Name - CECALL
Parameters
  P1    = '2'
  P2    = CDM-CS-RESULTS-FILE-ee
  P3    = CDM-CSQ-TABLE-ee
  P4    = CDM-RESULTS-ee
  MMMMM = program name from step 4.1

where ee = ES-NDML-NO
```

11.6.2 If language is COBOL, generate:

```
IF NOT CDM-CE-EOF
   ADD 1 TO NDML-COUNT
```

Else, generate:

```
ıF (EOFFLA .NE. '1') NDMLCT = NDMLCT + 1
```

11.6.3 Call "CDMACR" utility with the following:

```
Library Name - COBOL oı VAXFORTRAN or
               IBMFORTRAN
Macro Name - ERRCHK
Parameters
EE = ES-NDML-NO
```

11.7 Generate code to move the values in the result record to the named file.

Call function "CDP10C" to generate the moves with the following parameters:

```
LANG-NO
PROCFILE-NAME
ES-ACTION-LIST
CS-NDML-NO
FORTRAN-VARIABLE-TABLE
RET-STATUS
```

11.8 Generate code for completion of the loop for saving results into a file.

Call "CDMACR" utility with the following:

```
Library Name - COBOL
Macro Name - FILSAV2
Parameters
     EE = ES-NDML-NO

  Library Name - VAXFORTRAN or IBMFORTRAN
  Macro Name - FILSAV2
  Parameters
    EE = ES-NDML-NO
    P1 = FCB-CDM-RESULTS-ee

  where ee = ES-NDML-NO
```

12. Terminate processing.

37.5 Outputs

1. Error Status of the function

   RET-STATUS

2. Code generated into the parcels of the Application Program

LIBRARY NAME - COBOL

MACRO NAME - FILSAV1

PARAMETERS - EE
             F1

```
*
*    BEGIN SAVING RESULTS INTO USERS FILE
*
         IF CDM-CE-EOF
            GO TO END-NDML-EE.
         MOVE F1 TO CDM-RESULTS-NAME-EE.
         MOVE "W" TO DISPOSITION.
         CALL "OPNFIL" USING FCB-CDM-RESULTS-EE,
                             RET-STATUS,
                             CDM-RESULTS-NAME-EE,
                             DISPOSITION,
                             CDM-RECORD-LENGTH-EE,
                             NUMBER-OF-RECORDS.
         IF RET-STATUS NOT = KES-FILE-OK
            MOVE "ERROR OPENING FILE CDM-RESULTS-NAME-EE"
              TO MESG-DESC
            PERFORM PROCESS-ERROR
            GO TO EXIT-PROGRAM.
```

LIBRARY NAME - COBOL

MACRO NAME - CECALL

PARAMETERS - P1
             EE
             MMMMM

```
*
*    CALL CS-ES-TRANSFORM
*
     MOVE P1 TO CDM-CE-FLAG
     CALL "MMMMM" USING
                 CDM-CE-FLAG
                 CDM-CS-RESULTS-FILE-EE
                 CDM-CSQ-TABLE-CC
                 CDM-FLAG-ARRAY
                 CDM-RESULTS-EE
                 CDM-CE-EOF-FLAG
                 NDML-STATUS
```

LIBRARY NAME - COBOL

MACRO NAME - UAPWR

PARAMETERS - EE

```
     CALL "OUTFIL" USING
                         FCB-CDM-RESULTS-EE,
                         RET-STATUS,
                         CDM-RESULTS-REC-EE,
                         CDM-RECORD-LENGTH-EE.
     IF RET-STATUS NOT = KES-FILE-OK
        STRING "CDM-RESULTS-REC WRITE-ERROR: " RET-STATUS
             DELIMITED BY SIZE INTO MESG-DESC
        PERFORM PROCESS-ERROR
        GO TO
        END-NDML-EE.
```

LIBRARY NAME - FORTRAN

MACRO NAME - FILSAV1

```
PARAMETERS - EE
              F1
              P1
              P2
              P3

     IF (EOFFLA .EQ. '1') GO TO 93EE
     FILEST = 'W'
     P1     = F1
     CALL OPNFIL ( %REF(P2), %REF(NDMLST), %REF(P1)
*              , %REF(FILEST), %REF(P3), %REF(NUMREC))
     IF (NDMLST .NE. '00000') GO TO 93EE

94EE   CONTINUE
```

LIBRARY NAME - FORTRAN

MACRO NAME - CECALL

```
PARAMETERS - P1
             P2
             P3
             P4
             MMMMM

  CEFLAG = P1
  CALL MMMMM( %REF(CEFLAG), %REF(P2), %REF(P3)
*           , %REF(FLAGAR), %REF(P4), %REF(EOFFLA)
*           , %REF(NDMLST))
```

LIBRARY NAME - FORTRAN

MACRO NAME - UAPWR

PARAMETERS - EE
P1
P2
P3

```
      CALL OUTFIL ( %REF(P1), %REF(NDMLST)
     *            , %REF(P2), %REF(P3))
      IF (NDMLST .NE. '00000') GO TO 93EE
```

SECTION 38

FUNCTION PRE11 - BUILD SOURCE CODE

The function of the source code builder is to combine previously constructed parcels into a modified application process capable of servicing NDML requests and compilable by the appropriate host-compiler.

38.1 Inputs

1. Identification Parcel
2. File Parcel
3. Working-Storage Parcel
4. Procedure Parcel

38.2 Processing

Concatenate parcels 1, 2, 3 and 4. Then, return to PRE12 to continue precompiling the source programs for the user AP.

38.3 Output

1. Expanded Source Code - to be input to the appropriate host-language compiler.

SECTION 39

FUNCTION PRE12 - CONTROL PRECOMPILATIONS (MAIN ROUTINE)

This function:

1. Obtains input from the user about the set of input programs to be precompiled.
2. Verifies that the logical unit of work being precompiled exists. Verifies that this logical unit of work and the software module being precompiled is not being precompiled by another user at the same time.
3. Handles error checking and commit/rollback of any changes made to the CDM software module cross references.
4. Store new cross references of generated code.
5. Deletes references and source files of all generated code made obsolete by re-precompilation.

39.1 Inputs

1.	LUW-NAME	- this identifies the logical unit of work or transaction being precompiled.
2.	AP-TARGET-HOST	- this identifies the host of the IISS where the application code will be executed.
3.	AP-FILE-IN	- this identifies the file on which the input to the precompiler is found.
4.	ERROR-FILE	- this contains the name of the file which will contain the error messages encountered during execution.
5.	CDM-USER-NAME	- this identifies the ORACLE user name and password as input by user.
6.	FILE-DELETE-OPTION	- this contains the user's input to delete ("FD=N") or not to delete ("FD=Y") obsolete references to user's NDML module.

39.2 CDM Requirements

The entity classes needed are:

SOFTWARE_MODULE	=	SM	(E57)
CDMP_GENERATED_MOD	=	CGM	(E293)
NDML_MODULE	=	NM	(E292)
LOG_UNIT_WORK	=	LUW	(E291)
RECORD_SET_USAGE	=	RSU	(E299)
DATA_FIELD_USAGE	=	DFU	(E300)

39.3 Internal Data Requirements

The following table is used to maintain a list of files containing obsolete source code due to re-precompilation. The files cannot be deleted at the same time as their CDM references due to the effects of ROLLBACK. They can only be deleted when and if COMMIT is done.

```
1.  01   FILE-DELETE-LIST.
         02   FDL-MAX         PIC 99.    VALUE 50.
         02   FDL-USED        PIC 99.
         02   FDL-ENTRY         OCCURS 50 TIMES.
              04   FDL-FILE-NAME       PIC X(30).
              04   FDL-HOST-ID         PIC XXX.
              04   FDL-MODULE-NAME     PIC X(10).
```

39.4 Processing

1. Read the input directive containing logical unit of work, target host, input file name, error file name, CDM user name and file delete option. Logon to the database, using CDM-USER-NAME. If logon is not successful, write error message and exit program.

2. Open the file as input by user in AP-FILE-IN. If open is not successful, write error message and exit program.

3. Verify the presence of the user input logical unit of work (LUW-NAME) using LUW(E291). Call routine CDVERLW to perform this operation.

   3.1 Call routine CDLKLUW to look for the logical unit of work and if found to lock the row to prevent updating or precompiling with the same LUW. Retrieve the LAST-CASE-NO attribute.

   3.2 If the logical unit of work was not found, call routine CDINSLW to insert a new occurrence of LUW(E291) with LAST CASE-NO = 0. Perform step 2.1 to obtain a lock on this LUW.

4. Execute Function PRE1 by calling routine CDPRE1. This identifies the name of the user module to be precompiled and signals the end of input conditions. In addition, CDPRE1 partitions the input application program into four parcels which will be added to by other precompiler

components. On end of input, proceed to step 8. (Note: Only one logical unit of work can be specified per use of NDML precompiler).

5. Using the name of the software module being precompiled, call routine CDVERSM.

   5.1 If a logical unit of work is not locked due to a commit or rollback after precompiling a previous module in the same batch input, execute step 2.1 to obtain the lock.

   5.2 Select from NDML_MODULE entity NM(E292) the name of the user's software module. If found, retrieve the LUW-NAME attribute. This means this module has been precompiled previously.

      5.2.1 Compare the LUW of (E292) to the one entered by the user in step 1. If they do not match, return an error code and terminate precompilation of this software module.

      5.2.2 If the module names do match, drop all existing cross references to this software module. (NOTE: in the event of a failed precompilation, these will all be restored by the ROLLBACK action.)

         5.2.2.1 Call routine CDRPXREF. Search the CGM(E293) for all modules generated by searching on the attribute USER-MOD-ID = the value of USER-MOD-ID returned by Function PRE1. For each row found, delete all DFU(E300), RSU(E299) and SM(E57) entries for the GENERATED-MOD-ID returned in the search of CGM(E293). Retrieve and store the module name, file name and host identifier from the CGM(E293) search in the FILE-DELETE-LIST table. These files will be deleted later upon successful precompilation.

         5.2.2.2 Call routine CDRPESU to delete all external schema references from ES_USAGE(E282) for the MOD_ID returned in the search of CGM(E293).

         5.2.2.3 Call routine CDDGAP to delete all rows from CGM(E293) for the user module being re-precompiled.

5.3 If the module name was not found, insert a new occurrence of both SM(E57) and NM(E292). The values for SM(E57) are:

MOD_ID	= the USER-MOD-ID from Function PRE1
LANG_NAME	= the SOURCE-LANGUAGE returned from Function PRE1
LATEST_REV_DATE	= the date when the software module was last revised or first implemented if never revised
STATUS_IND	= "N" to indicate an NDML user module

The values for NM(E292) are:

MOD_ID	= the USER-MOD-ID
LUW_NAME	= logical unit of work from user input
PRECOMP_DATE	= latest date the NDML module was successfully precompiled.
LAST_COMP_STAT	= value "N"

Commit both inserts. This row will be saved even if the module precompiles with errors.

5.4 Because a commit was done in 5.3, the lock for LUW(E291) must be re-obtained. Perform step 3.1.

6. Perform precompilation of a single user module by executing Function PRE2.

7. If precompilation was successful, combine all parcels of code generated to become a modified user module by executing Function PRE11.

8. Perform error checking for precompilation of this user module by calling routine CDECHK.

8.1 If the module was precompiled successfully, for each new entry added to the CG table for the user routine, insert generated AP references.

8.1.1 If MOD_TYPE is not equal to "USER-MOD" insert a new row into the generated module CDM table (CGM) as follows:

GENERATED_MOD_ID	= CGT-MOD-NAME
USER_MOD_ID	= USER-MOD-ID from Function PRE1
GENERATED_BY	= CGT-GENED-BY
GEN_DATE	= today's system date
MODULE_TYPE	= CGT-MOD-TYPE
CASE_NO	= CGT-CASE-NO
IS_ACTION	= type of request processor action
FILE_NAME	= CGT-GEN-FILE-NAME
HOST_ID	= CGT-TARGET-HOST
DB_ID	= CGT-DBID
LUW_NAME	= the current LUW

	being precompiled
LOCAL_REMOTE	= CGT-LOCALITY
SUBTRANS_ID	= subtransaction identifier

8.1.2 Insert a new row into the software module table (SM) as follows:

MOD_ID	= CGT-MOD-NAME
LANG_NAME	= CGT-LANGUAGE
LATEST_REV_DATE	= system date
STATUS_IND	= "G" for generated

8.1.3 If MOD-TYPE is equal to "USER-MOD", store a reference to the generated, modified user module in the the generated module CDM table (CGM), the software module table (SM) and update the last case number on the previously locked LUW (E291) row.

8.1.4 Update NDML_MODULE (NM) to indicate a successful precompilation as follows:

LAST_COMP_STAT	= status code indicating success
PRECOMP_DATE	= system date

8.1.5 Delete any obsolete code files at the user's option. If file delete option is requested, delete each file found on the FILE-DELETE-LIST. Note that these are not necessarily on the same computer as the precompiler. Save the names of obsolete object code.

Open the file OBSOBJ and write the name of each module and its host of residence to the file from the FILE-DELETE-LIST. This will be used to periodically clear object libraries of obsolete code.

8.1.6 Increment the good precompile counter.

8.2 If the module was not precompiled successfully,

8.2.1 Increment the bad precompile counter.

8.2.2 Delete the files containing the generated code which were added to the CODE_GENERATOR_TABLE for this bad precompilation.

8.2.3 Delete the four parcels created during the bad precompile.

8.2.4 Rollback all changes made to the CDM.

8.2.5 Update NDML_MODULE (NM) to indicate an unsuccessful precompilation and commit this change to the database.

8.3 Commit all database changes and logoff from the CDM's DBMS, if end of file was encountered. If not end of file, return to step 4 to precompile the next module found on the user's input file.

9. When the end of user's input file is encountered, display a message showing number of good and bad precompiles, followed by a report of all modules successfully precompiled. If the user did not request the file delete option, a list of obsolete code is displayed.

39.5 Outputs

1. CODE-GENERATOR-TABLE - This table will maintain a single row for each file of generated code. Entries refer to the various types of generated software.

   -CS-ES Transform
   -CS Selector
   -Request Processor Main
   -Modified User Module

   This information must be saved in the CDM to track all generated code.

2. OBSOBJ - This is a sequential file designed to hold the host, module, and file names for each module of generated code made obsolete due to a deleted user module containing NDML or a re-precompilation. This is designed to allow a JCL utility (not designed at this time) to be periodically executed to read the file OBSOBJ.DAT and for each entry, delete the object code from the library of generated code at each node of IISS. This is designed as an interim solution. Eventually, RCL service should use the information to dynamically remove objects from the libraries.

   The file will consist of a single record description.

```
01   OBSOLETE-OBJECT.
     03   OBJ-HOST-ID          PIC XX.
     03   FILLER               PIC XXX.
     03   OBJ-FILE-NAME        PIC X(30).
     03   FILLER               PIC XXX.
     03   OBJ-MODULE-NAME      PIC X(10).
     03   FILLER               PIC XXX.
     03   OBJ-TIME-STAMP       PIC X(22).
```

3. GOOD-PRECOMPILES, BAD-PRECOMPILES - Counters to record the number of successful and unsuccessful routines precompiled.

4. Report Results - A listing of all successfully precompiled modules, displaying the module name, language, target host, DBMS, database, locality (remote or local), module type and file name.

SECTION 40

FUNCTION PRE13 - CONTROL CODE GENERATION

This function controls the generation of source code for a single request in conceptual schema terms. It also controls the selection of access paths for databases that require them and assigns unique names for RPs and CS-ES transformers. It determines the name of the AP that a request processor subroutine will be called by.

40.1 Inputs

1. The following tables and lists are simply passed on to other modules:

ES-ACTION-LIST	from PRE4 to PRE8, PRE10
ES-QUALIFY-LIST	from PRE4 to PRE10
CS-ACTION-LIST	from PRE5 to PRE8, PRE10
CS-QUALIFY-LIST	from PRE5 to PRE9, PRE10
IS-ACTION-LIST	from PRE5 to PRE6, PRE9
IS-QUALIFY-LIST	from PRE5 to PRE6, PRE9, PRE10
JQG	from PRE5 to PRE10
RFT	from PRE5 to PRE9, PRE10
SET-TABLE	from PRE5 to PRE6, PRE9
OCCURS-TABLE	from PRE5 to PRE6
COMPLEX-MAPPING-ALG-TABLE	from PRE5 to PRE6
ACCESS-PATH (several tables)	from PRE6 to PRE7
ERRFILE	
UV-ABBR-LIST	
JQG-ATTRIBUTE-PAIR-LIST	
BOOLEAN-LIST	
SUBTRANS-PROCESS-ID-TABLE	
SUBTRANS-BOOLEAN-LIST	
BLOCK-STACK	
FIRST-INNER-SELECT	

2. MY-HOST
   TARGET-HOST
   PARCL1
   PARCL2
   PARCL3
   PARCL4
   LUW-NAME
   SOURCE-LANGUAGE
   IOSECTION-INDICATOR

3. CODE-GENERATOR-TABLE, which is received from PRE12 and in which PRE13 records information about generated RPs and CS-ES transformers.

4. Logical Unit Of Work being precompiled.

5. CDM Meta Data

The entity classes needed are:

CDMP_GENERATED_MOD = CGM (E293)

40.2 Processing

1. Determine the name of the RP driver. Given the database id (DBID) that the request processor subroutine is to access and the logical unit of work (LUW-NAME) currently being precompiled:

    1.1 Search for an entry in the CODE-GENERATOR-TABLE where:

    ```
    CGT-DBID      = DBID and

    CGT-MOD-TYPE = "RP-MAIN"
    ```

    If an entry is found, return the CGT-MOD-NAME and CGT-LOCALITY as output of this sub-function.

    1.2 If an entry in CGT is not found, search the CDM for the locality and MOD-ID given the logical unit of work and database ID of the subtransaction.

    Search CDMP_GENERATED_MOD (E293) where:

    ```
         LUW_NAME      = LUW being precompiled
         DBID          = database ID of the
    subtransaction
         MODULE_TYPE   = 'RP-MAIN'
    ```

    If an entry was found, return LOCALITY and MOD-ID as output of this sub-function.

    1.3 If an RP driver name was not located in step 1.1, execute the module name generator function APNAME to derive a new subroutine module name.

    1.3.1 Determine if this RP-MAIN will be remote (accessed by the NTM) or local (accessed by a direct call from the DRS). Search the CDM entity class CDMP_GENERATED_MOD (E293) where:

    ```
    LUW_NAME         = LUW being precompiled
    LOCAL_REMOTE     = 'L'
    MODULE_TYPE      = 'RP-MAIN'
    ```

    1.3.1.1 If such a row is found, store a value of "R" in the variable LOCALITY; since there are other LOCAL RP's, this one must be remote.

    1.3.1.2 If a row was not found and the

TARGET-HOST is equal to the RP-SUB-HOST, search the entire CG Table for an RP-MAIN entry with a CGT-LOCALITY = "L". This RP can only be local if there are no locals in the CGT and it is to run on the same host as the target host of the user's AP. If one is not found, set LOCALITY = "L", else set LOCALITY = "R".

1.3.1.3 If a row was not found in step 1.3.1 and TARGET-HOST is not equal to RP-SUB-HOST, move "R" to LOCALITY.

1.4 Convert this name to an NTM application name by concatenating, in order, the NTM-DIRECTORY, the MOD-NAME and three trailing Z's if LOCALITY = "R". Note the trailing Z's are an NTM workaround. If LOCALITY, "L" use only the MOD-NAME. Create a new entry in the CGT for this RP-MAIN entry:

CGT-MOD-NAME	= the concatenated name
CGT-LANGUAGE	= "COBOL"
CGT-TARGET-HOST	= the host-id of the RP-SUB currently being generated
CGT-DBMS	= the DBMS of the RP-SUB currently being generated
CGT-DB-NAME	= the name of the database for which the RP-SUB is currently being generated
CGT-MOD-TYPE	= "RP-MAIN"
CGT-GENED-BY	= "CDP14"
CGT-DBID	= the database id of the RP-SUB currently being generated
CGT-CURRENT-HOST	= "VAX"
CGT-RCL-STATUS	= "COMP"

1.5 Get a file name on which the RP-MAIN will be generated at a later time.

2. Next, select a unique name for the RP subroutine to be generated for the subtransaction by executing the function APNAME.

3. Generate the COBOL code required to execute NDML subtransactions.

3.1 Invoke the appropriate version of PRE9 to generate an RP-SUB for the database to be accessed, passing it the selected RP name:

PRE9.2	for SQL databases
PRE9.3	for CODASYL databases
PRE9.4	for TOTAL databases
PRE9.5	for IMS databases

If the subtransaction is for a CODASYL or TOTAL database, invoke PRE6, passing it the IS-ACTION-LIST and the IS-QUALIFY-LIST, to select an access path through the database. When PRE6 is finished, invoke PRE7 to transform the access path into generic DML statements.

Save information about each routine generated in the CODE-GENERATOR-TABLE.

CGT-DBID	= database ID the RP-SUB will access
CGT-DBMS	= ORACLE, DB2, IDS-II, IDMS, VAX-11 or TOTAL
CGT-LIBRARY-NAME	= library where macros used reside
CGT-DB-NAME	= database name RP-SUB will access
CGT-TARGET-HOST	= HOST-ID
CGT-MOD-NAME	= selected RP name
CGT-GEN-FILE-NAME	= GEN-FILE-NAME
CGT-MOD-TYPE	= "RP-SUB" or "USER-MOD"
CGT-GENED-BY	= subroutine which generated the code
CGT-ACTION	= IS-ACTION
CGT-SUBTRANS-ID	= SUB-SCRIPT
CGT-CASE-NO	= CS-NDML-NO
CGT-SCHEMA	= DB-SCHEMA
CGT-SUBSCHEMA	= DB-SUBSCHEMA
CGT-DB-LOCATION	= DB-LOCATION
CGT-PASSWORD	= DB-PASSWORD
CGT-CURRENT-HOST	= name of host computer
CGT-RCL-STATUS	= "GEN"
CGT-LANGUAGE	= "COBOL" or SOURCE-LANGUAGE if MOD-TYPE = "USER-MOD"

3.2 When the PRE9 version is finished, repeat Steps 1 through 3.1 for the next subtransaction, if any.

4. Control the code generation for NDML conceptual requests.

If ES-ACTION is:

B	(BEGIN)	or
C	(COMMIT)	or
R	(ROLLBACK)	or
N	(NEXT)	or
E	(END CURLEY)	or
X	(BREAK)	or

M (MODIFY) or
D (DELETE) or
I (INSERT)

invoke PRE10 to generate code into the source program. When PRE10 is finished, return to PRE5.

5. If ES-ACTION is:

S (SELECT) or
Q (QUERY COMBINATION) or
1 (TYPE 1 REFERENTIAL INTEGRITY) or
2 (TYPE 2 REFERENTIAL INTEGRITY) or
K (KEY UNIQUENESS)

5.1 Call routine APNAME to get a unique name for the conceptual to external transformer.

This routine maintains a buffer (Module Name Table) of 20 module names and passes out one on each call. If the buffer is empty, it sends an NTM message to the Module Name Q-server to acquire 20 new unique names. For a description of this Q-server, see the File Utilities DS, DS#620241330.

5.1.1 Upon request, increment the last used index of the module name table.

5.1.2 If the index exceeds the size of the table:

Issue a message to module name Q-server.

Wait on a reply from the Q-server.

On a successful message, store the data of the message in the module name table and set the last used index of the table to zero. Return to step 5.1.1.

5.1.3 If the index does not exceed the maximum, return the entry in the module name table pointed to by the index. (Note, this routine is not re-entrant. The index cannot be reset on each invocation).

5.2 Perform the following depending on the contents of ES-ACTION.

5.2.1 If ES-ACTION = 'S' and is not part of an NDML query combination command, invoke PRE8 to generate a CS-ES transformer, passing it the selected CS-ES transformer name. Record it in the CODE-GENERATOR-TABLE as follows:

CGT-DBID	= 0
CGT-DBMS	= spaces
CGT-LIBRARY-NAME	= name of the macro library from which code is generated
CGT-DB-NAME	= spaces
CGT-TARGET-HOST	= name of the host computer on which the user AP will be run
CGT-MOD-NAME	= selected name for the CS-ES transformer
CGT-GEN-FILE-NAME	=GEN-FILE-NAME
CGT-MOD-TYPE	= "CS-ES"
CGT-GENED-BY	= "CDPRE8"
CGT-SUBTRANS-ID	= 0
CGT-CASE-NO	= 0
CGT-ACTION	= spaces
CGT-SCHEMA	= spaces
CGT-SUBSCHEMA	= spaces
CGT-DB-LOCATION	= spaces
CGT-DB-PASSWORD	= spaces
CGT-CURRENT-HOST	= name of the host computer on which the source program is being precompiled
CGT-RCL-STATUS	= "GEN"
CGT-LANGUAGE	= "COBOL"

5.2.2 If ES-ACTION = "Q" indicating an inner select, we need only transform the results to CS terms. Invoke CDPRE8C to generate a CS-CS transformer for an inner SELECT of an NDML query combination command. Record it in the CODE-GENERATOR-TABLE as follows:

CGT-DBID	= 0
CGT-DBMS	= spaces
CGT-LIBRARY-NAME	= name of the macro library from which code is generated
CGT-DB-NAME	= spaces
CGT-TARGET-HOST	= name of the host computer on which the user AP will be run
CGT-MOD-NAME	= selected name for the CS-ES transformer
CGT-GEN-FILE-NAME	= GEN-FILE-NAME
CGT-MOD-TYPE	= "CS-CS"
CGT-GENED-BY	= "CDPRE8C"
CGT-SUBTRANS-ID	= 0
CGT-CASE-NO	= 0
CGT-ACTION	= spaces
CGT-SCHEMA	= spaces

CGT-SUBSCHEMA	= spaces
CGT-DB-LOCATION	= spaces
CGT-DB-PASSWORD	= spaces
CGT-CURRENT-HOST	= name of the host computer on which the source program is being precompiled
CGT-RCL-STATUS	= "GEN"
CGT-LANGUAGE	= "COBOL"

5.2.3 If ES-ACTION = "2" or "1" or "K", invoke CDPRE8D to generate a CS-CS transformer for a type1 or type2 referential integrity test or a key uniqueness test, passing it the selected CS-CS transformer name. Record it in the CODE-GENERATOR-TABLE as follows:

CGT-DBID	= 0
CGT-DBMS	= spaces
CGT-LIBRARY-NAME	= name of the macro library from which code is generated
CGT-DB-NAME	= spaces
CGT-TARGET-HOST	= HOST-ID
CGT-MOD-NAME	= selected name for the CS-ES transformer
CGT-GEN-FILE-NAME	= GEN-FILE-NAME
CGT-MOD-TYPE	= "CS-CS"
CGT-GENED-BY	= "CDPRE8D"
CGT-SUBTRANS-ID	= 0
CGT-CASE-NO	= 0
CGT-ACTION	= spaces
CGT-SCHEMA	= spaces
CGT-SUBSCHEMA	= spaces
CGT-DB-LOCATION	= spaces
CGT-DB-PASSWORD	= spaces
CGT-CURRENT-HOST	= name of the host computer on which the source program is being precompiled
CGT-RCL-STATUS	= "GEN"
CGT-LANGUAGE	= "COBOL"

5.3 Invoke PRE10 to generate code into the source program. When PRE10 is finished, return to PRE5.

40.3 Outputs

1. CODE-GENERATOR-TABLE, which is received from PRE12 and in which PRE13 records information about generated RPs and CS-ES transformers.

2. RET-STATUS - a status code indicating whether function was executed successfully.

SECTION 41

FUNCTION PRE14 - REQUEST PROCESSOR DRIVER GENERATOR

This function is a stand alone program used after precompile time, but before application usage or runtime. It would be executed at the same time a link is done in the normal programming scenario of edit, compile, link and run. Because the NDML Precompiler only generates request processor subroutines and many precompiles can be done separately and independently, a separate "link" step to generate a Request Processor Driver (RPD) is needed. No one usage of the precompiler can generate an RPD since information on all RP subroutines generated for a logical unit of work is necessary. (The separate precompilation feature allows different modules of the same logical unit of work to be precompiled at separate times, without re-precompiling other, unaffected modules). The CDM will act as the library or directory of all generated code. With this information, PRE14 can generate RPDs with the correct names when the user indicates precompilation of all modules in a logical unit of work is complete.

41.1 Inputs

1. Logical Unit of Work - this identifies the logical unit of work, or transaction for which RPDs must be generated. This is a user input.

2. CDM user name - this identifies the user name needed to access the database. This is user input.

41.2 CDM Requirements

The entity classes needed are:

SOFTWARE_MODULE	=	SWM	(E57)
LOG_UNIT_WORK	=	LUW	(E291)
NDML_MODULE	=	NM	(E292)
RP_MAIN	=	RPM	(E298)
CDMP_GENERATED_MOD	=	CGM	(E293)
RP_SUB_ROUTINE	=	RSM	(E295)
DATA_BASE	=	DB	(E24)
DB_PASSWORD	=	DBP	(E25)
SCHEMA-NAMES	=	SS	(E14)

41.3 Processing

1. Perform user interface to the function.

    1.1 Initiate processing by connecting with the NTM using INITIAL or INITEX service, depending on the choice of option in step 1.2 below. All options but 1.2.1 will require INITEX.

    1.2 Upon initiation, obtain the name of a logical unit of work from the user. Note this specification does not detail how this is to be done. Options are:

1.2.1 Use of User Interface Subsystem forms.

1.2.2 Simple Sequential file, allowing batch usage.

1.2.3 COBOL DISPLAY and ACCEPT for simple prompted input.

1.2.4 Operating System dependent input parameter such as the UNIX "args" concept.

2. Perform generation of each Request Processor Driver.

2.1 Logon to the ORACLE CDM data base using the input CDM user name.

2.2 Verify that the logical unit of work input parameter exists in the CDM (LUW (E291)) and lock this occurrence. This is the same processing as step 3.1 of PRE12, Control Precompilation.

2.2.1 If found, lock the row, preventing other user's from updating or precompiling with the same LUW.

2.2.2 If the LUW is not found, set the proper error return status, terminate this function and display error message.

2.3 Verify that all NDML modules have been precompiled successfully for this logical unit of work by searching CDM NDML_MODULE entity for LAST_COMP_STAT not equal to "5". If any bad precompiles are found, set the proper error return status, terminate this function and display error message.

2.4 Search CDM entity CGM (E293) for each occurrence matching the logical unit of work input parameter and MODULE_TYPE = 'RP-MAIN'. Retrieve the MOD-ID, DB-ID, RP-MAIN-FILE and LOCAL-REMOTE attributes. For each row found:

2.4.1 Determine parameters needed for the generation of the RPD data base logon, the schema section, and Data Division of the RPD. Using the DB-ID attribute from the search of step 2.4, retrieve the following attributes from the named entities using DB_ID as the search value:

DBMS-NAME	from	E24
HOST_ID	from	E24
DB_NAME	from	E24
LIBRARY_NAME	from	E14

SCHEMA_NAME	from	E14
SUBSCHEMA_NAME	from	E14
DB_LOCATION	from	E25
DB_PASSWORD	from	E24
CHARACTER_NULL	from	E24
INTEGER_NULL	from	E24
NTM_DIRECTORY	from	E24

(Implementation note: an OUTER-JOIN can identify these with one search. Be aware that some attributes will be null for some DBMS types).

2.4.2 Delete the old version, if any, of the RP-MAIN file since the macro used to generate the RPDs writes to the end of a file (OPEN EXTEND) if one by that name already exists.

2.4.3 Call routine CDMACR to generate code into the RPD. Using the library name and module name, along with a substitution parameter list from Step 2.4.1, macros chosen from the CDM are written to the output file, the name of which is in RP-MAIN-FILE. These macros write code containing the IDENTIFICATION DIVISION, ENVIRONMENT DIVISION, DATA DIVISION and the beginning of the PROCEDURE DIVISION to the RPD.

The parameters used are as follows:

```
RP-MAIN-FILE        from  Step 2.4
LIBRARY-NAME        from  E14
MACRO-NAME          RPSTART if LOCAL-REMOTE = "R"
                       else
                    RPGO
SUBSTITUTION-LIST contains MOD-ID
                           DB-NAME
                           SCHEMA-NAME
                           DB-PASSWORD
                           DB-LOCATION
                           SUBSCHEMA-NAME
RET-STATUS
```

2.4.4 Generate a call to each RP subroutine into the RPD Procedure Division. Identify each RP-SUB participating in the logical unit of work for this data base. Select the CASE_NO, SUBTRANS_ID and GENERATED_MOD_ID from CDMP_GENERATED_MOD (E293) for the MODULE_TYPE of 'RP-SUB', the DB_ID from Step 2.4 and the user input logical unit of work.

2.4.5 If no rows are returned, an "obsolete" RP-MAID has been encountered. This occurs when all RP-subroutines for a particular database have been deleted by re-precompilation of an NDML request after a change in the CS-IS mapping. (The request no longer needed that particular database). In this case:

2.4.5.1 Delete the RP-MAIN reference from CDMP_GENERATED_MOD (E293) for MODULE-TYPE of 'RP-MAIN' and the MOD-ID from step 2.4.

2.4.5.2 Delete the RP-MAIN reference from SOFTWARE_MODULE (E57).

2.4.5.3 Delete the RP-MAIN driver partially built in step 2.4.3.

2.4.5.4 The RPD is now deleted. Clear the "obsolete" error code and continue processing at step 2.4.

2.4.6 If a row was returned from the Select in step 2.4.4, generate the termination Procedure Division code of the RPD. Call routine CDMACR for the appropriate macro using:

RP-MAIN-FILE	from step 2.4
LIBRARY-NAME	from E14
MACRO-NAME	RPEND if LOCAL-REMOTE ="R" else RPSTOP
SUBSTITUTION-LIST	no parameters
RET-STATUS	

2.5 Record a new entry in the CODE-GENERATOR table for the RPD just established.

CGT-MOD-NAME	= MOD-ID retrieved in step 2.4
CGT-LANGUAGE	= "COBOL"
CGT-TARGET-HOST	= HOST-ID of E24
CGT-DBMS	= DBMS-NAME of E24
CGT-DB-NAME	= DB-NAME of E24
CGT-MOD-TYPE	= "RP-MAIN"
CGT-GEN-FILE-NAME	= RP-MAIN-FILE of E293
CGT-DBID	= DB-ID of E293
CGT-LIBRARY-NAME	= LIBRARY-NAME of E14
CGT-SUBTRANS-ID	= 0
CGT-CASE-NO	= 0
CGT-CURRENT-HOST	= Current host on which PRE14 is executing. (NTM can be used to determine the host or host can be hard wired into machine dependent

```
                                versions)
    CGT-RCL-STATUS            = "GEN"
    CGT-LOCALITY              = LOCAL-REMOTE of E293
```

2.6 When all rows have been processed, terminate generation of RPDs. Commit changes made to database.

3. Display the results of RPD generation to the user. Depending on the user interface option chosen, this may be (corresponding choices):

   3.1 Use of User Interface output form

   3.2 Output to a formatted sequential file

   3.3 COBOL DISPLAY's for a listing on the terminal

   3.4 Operating system dependent, e.g. UNIX standard output

   The colunms of the CODE-GENERATOR-TABLE to be output should be:

   ```
   CGT-MOD-NAME
   CGT-LANGUAGE
   CGT-TARGET-HOST
   CGT-DBMS
   CGT-DB-NAME
   CGT-GEN-FILE-NAME
   CGT-MOD-TYPE
   CGT-LOCALITY
   ```

   The user must be warned to remember the module name of the "local" RPD, which is a subroutine. This name will be needed when linking the user AP (on VAX) because of COBOL dynamic calls used by the DRS.

4. Terminate the NTM connection by using the "TRMNAT" service (or "TRMNDML" if the NDML is used).

41.4 Outputs

1. One RPD program will be generated for each RP-MAIN for the given logical unit of work. There is one RPMAIN in the CDM for each data base involved in the user's transaction or logical unit of work.

2. CODE-GENERATOR-TABLE

   This table tracks all generated software and holds pertinent results about all code generated or modified by the precompiler.

* CGTABLE.INC

```
 01   CODE-GENERATOR-TABLE
 03   CGT-USED                  PIC 999 VALUE 0.
 03   CGT-MAX                   PIC 999 VALUE 189.
 03   CGT-ENTRY   OCCURS 190 TIMES    INDEXED BY CGT-INDEX
      05   CGT-MOD-NAME         PIC X(10).
      05   CGT-LANGUAGE         PIC X(8).
      05   CGT-TARGET-HOST      PIC XXX.
      05   CGT-DBMS             PIC X(30).
      05   CGT-DB-NAME          PIC X(30).
      05   CGT-MOD-TYPE         PIC X(10).
           88   USER-MODULE     VALUE "USER-MOD".
           88   RP-MAIN         VALUE "RP-MAIN".
           88   RP-SUB          VALUE "RP-SUB".
           88   CS-ES           VALUE "CS-ES".
      05   CGT-ACTION           PIC X.
      05   CGT-GENED-BY         PIC X(10).
      05   CGT-GEN-FILE-NAME    PIC X(30).
      05   CGT-PASSWORD         PIC X(30).
      05   CGT-LOCALITY         PIC X.
           88   CGT-LOCAL       VALUE "L".
           88   CGT-REMOTE      VALUE "R".
*
*     THE ABOVE CAN BE SHOWN TO THE USER, THE FOLLOWING ARE FOR
*     RCL AND INTERNAL USAGE:
      05   CGT-DBID             PIC 9(6).
      05   CGT-LIBRARY-NAME     PIC X(30).
      05   CGT-SUBTRANS-ID      PIC 9(6).
      05   CGT-CASE-NO          PIC 9(6).
      05   CGT-SCHEMA           PIC X(30).
      05   CGT-SUBSCHEMA        PIC X(30).
      05   CGT-DB-LOCATION      PIC X(30).
      05   CGT-PASSWORD         PIC X(30).
*     THE FOLLOWING ARE REQUIRED FOR RCL FUNCTIONS
      05   CGT-LOG-FILE-NAME    PIC X(30).
      05   CGT-RCL-LOG-CHAIN    PIC XXX.
      05   CGT-CURRENT-HOST     PIC XXX.
*     NOTE THAT CURRENT HOST MAY CHANGE DURING THE RCL PROCESS
      05   CGT-RCL-STATUS       PIC X(5).
           88   CODE-GEN        VALUE "GEN".
           88   CODE-XFERRED    VALUE "XFER".
           88   CODE-COMPILED   VALUE "COMP".
           88   AP-LINKED       VALUE "LINK".
           88   AP-DEFINED      VALUE "NTM".
```

LIBRARY: ORACLE
MACRO: RPSTART

```
     IDENTIFICATION DIVISION.
     PROGRAM-ID.  P1.
     ENVIRONMENT DIVISION.
     DATA DIVISION.
     WORKING-STORAGE SECTION.
     01  RET-STATUS     PIC X(5).
     01  MODULE-NAME    PIC X(10) VALUE IS "P1".
     01  MESG-DESC      PIC X(60).
     01  RP-SUB-NAME    PIC X(6).
*     REPLY TO DRS
     01   MESSAGE-BODY-OUT.
          03  OUTFILE-NAME       PIC X(80).
          03  REC-COUNT          PIC 9(6) VALUE ZERO.
          03  QP-STATUS          PIC 9(5).
     01   MSG-OUT-L     PIC 9(5) COMP VALUE 91.
*      NTM STUFF
     01  BUFFER         PIC X(4096).
     01  BUFFER-SIZE    PIC 9(6) VALUE 4096.
     01  DATA-TYPE      PIC X.
     01  NTM-DESTINATION        PIC X(10).
     01  LOGICAL-CHANNEL        PIC X(3).
     01  MESSAGE-TYPE   PIC X(2).
     01  OUT-MESSAGE-TYPE       PIC XX VALUE "RR".
     01  MESSAGE-SERIAL-NUMBER PIC X(7).
     01  NTM-SOURCE     PIC X(10).
     01  TERMINATION-STATUS     PIC X  VALUE SPACE.
     01  TIMEOUT-VALUE PIC X(15) VALUE ZEROES.
     01  WAIT-FLAG      PIC 9 VALUE 1.
     01  DATA-LENGTH    PIC 9(5) COMP.
     COPY ERRCDM OF IISSCLIB.
     COPY CHKCDM OF IISSCLIB.
     COPY SRVRET OF IISSCLIB.
     01  SHOW-RC        PIC ----9.
*     MESSAGE FROM DRS
     01  MESSAGE-BODY-IN.
          03  CASE-NO  PIC X(6).
          03  SUB-ID   PIC XXX.
          03  MESSAGE-PARAMETERS.
               05  USER-PW    PIC X(21).
               05  FILLER     PIC X(1979).
*   WS FOR ORACLE
       EXEC SQL BEGIN DECLARE SECTION END-EXEC.

     01  OUNAM PIC X(30) VALUE "P2".
     01  OUPWD PIC X(30) VALUE "P4".
     01  USER-NAME  PIC X(30).
          EXEC SQL END DECLARE SECTION END-EXEC.
          EXEC SQL INCLUDE SQLCA END-EXEC.
     PROCEDURE DIVISION.
     START-HERE.
     CALL "INITAL" USING BUFFER,
                         BUFFER-SIZE,
                         SYSTEM-STATE,
                         RET-CODE.
```

```
IF INITAL-SUCCESSFUL
  NEXT SENTENCE
ELSE
  MOVE "RP CANNOT START" TO MESG-DESC
  MOVE RET-CODE TO RET-STATUS
  PERFORM PROCESS-ERROR
  GO TO PGM-END.
WAIT-HERE.
  MOVE SPACES TO OUTFILE-NAME.
  MOVE ZEROES TO REC-COUNT.
  MOVE SPACES TO LOGICAL-CHANNEL, NTM-SOURCE, MESSAGE-TYPE.
  CALL "RCV" USING LOGICAL-CHANNEL,
                   WAIT-FLAG,
                   NTM-SOURCE,
                   MESSAGE-TYPE
                   DATA-LENGTH,
                   MESSAGE-BODY-IN,
                   ACCEPT-STATUS,
                   MESSAGE-SERIAL-NUMBER.
IF RCV-NORMAL-MESSAGE
    NEXT SENTENCE
ELSE
    MOVE "UNABLE TO RECEIVE DRS REQUEST" TO MESG-DESC
    MOVE ACCEPT-STATUS TO RET-STATUS
    PERFORM PROCESS-ERROR
       GO TO PGM-ABORT.
    MOVE ZEROES TO RET-STATUS.

TRY-OPEN.
    IF CASE-NO NOT = "000000" GO TO TRY-CLOSE.
*
*    ORACLE LOGON
*

    MOVE USER-PW TO USER-NAME.
   EXEC SQL CONNECT :USER-NAME  END-EXEC.
   IF SQLCODE = 0  GO TO END-CASE-CHECK.
   EXEC SQL CONNECT :OUNAM
   IDENTIFIED BY :OUPWD
   END-EXEC.
   IF SQLCODE < 0
         MOVE KES-OLOGON-ERROR TO RET-STATUS
      MOVE SQLCODE TO SHOW-RC
      STRING "BAD ORACLE LOGON:"         DELIMITED BY SIZE
      SHOW-RC                            DELIMITED BY SIZE
      INTO MESG-DESC
      GO TO PGM-ABORT.
    GO TO END-CASE-CHECK.
TRY-CLOSE.
   IF CASE-NOT = "CLS" GO TO TRY-BEGIN.
   GO TO END-CASE-CHECK.
TRY-BEGIN.
   IF CASE-NO NOT = "BEG" GO TO TRY-COMMIT.
   GO TO END-CASE-CHECK.
TRY-COMMIT.
   IF CASE-NO NOT = "CMT"
      GO TO TRY-ROLLBACK.
   EXEC SQL
      COMMIT WORK
```

```
            END-EXEC.
        IF SQLCODE <  0
           MOVE KES-NOCOMMIT TO RET-STATUS
           MOVE SQLCODE TO SHOW-RC
           STRING "UNABLE TO COMMIT"           DELIMITED BY SIZE
                  SHOW-RC                      DELIMITED BY SIZE
                  INTO MESG-DESC
           GO TO PGM-ABORT
        ELSE
           GO TO END-CASE-CHECK.
        TRY-ROLLBACK.
           IF CASE-NO NOT = "RBK"
              GO TO END-FIXED-CASES.
           EXEC SQL ROLLBACK WORK          END-EXEC.
           IF SQLCODE <  0
              MOVE KES-NOROLLBACK TO RET-STATUS
              MOVE SQLCODE TO SHOW-RC
              STRING "UNABLE TO ROLLBACK"  DELIMITED BY SIZE
                     SHOW-RC               DELIMITED BY SIZE
                  INTO MESG-DESC
              GO TO PGM-ABORT
           ELSE
              GO TO END-CASE-CHECK.
       END-FIXED-CASES.
           MOVE CASE-NO TO RP-SUB-NAME.
       CALL RP-SUB-NAME USING MESSAGE-BODY-IN
                              MESSAGE-BODY-OUT
       ON EXCEPTION
           MOVE KES-NO-RPSUB-ERROR TO RET-STATUS
           STRING " CANNOT CALL: "
                   RP-SUB-NAME
                 " CASE/SUB: "
                 CASE-NO
                 SUB-ID  DELIMITED BY SIZE
       INTO MESG-DESC
       GO TO PGM-ABORT.
   *
   *
   *
       MOVE QP-STATUS TO RET-STATUS.
       GO TO END-CASE-CHECK.
```

ORACLE REQUEST PROCESSOR MACROS

LIBRARY: ORACLE
MACRO: RPGO

```
  IDENTIFICATION DIVISION.
  PROGRAM-ID. P1.
  ENVIRONMENT DIVISION.
  DATA DIVISION.
  WORKING-STORAGE SECTION.
  01  RET-STATUS       PIC X(5).
  01  MODULE-NAME      PIC X(10) VALUE IS "P1".
  01  MESG-DESC        PIC X(60).
  01  RP-SUB-NAME   PIC X(6).
  01  SHOW-RC  PIC ----9.
  01  MSG-OUT-L        PIC 9(5) COMP VALUE 91.
       COPY ERRCDM OF IISSCLIB.
       EXEC SQL BEGIN DECLARE SECTION END-EXEC.
  01  USER-NAME    PIC X(30).
  01  OUNAM            PIC X(30) VALUE "P2".
  01  OUPWD            PIC X(30) VALUE "P4".
      EXEC SQL END DECLARE SECTION END-EXEC.
      EXEC SQL INCLUDE SQLCA END-EXEC.
  LINKAGE-SECTION.
*     REPLY TO DRS
  01  MESSAGE-BODY-OUT.
      03  OUTFILE-NAME         PIC X(80).
      03  REC-COUNT                    PIC 9(6).
      03  QP-STATUS                    PIC X(5).
 *   MESSAGE FROM DRS
  01  MESSAGE-BODY-IN.
      03  CASE-NO                      PIC X(6).
      03  SUB-ID                       PIC XXX.
      03  MESSAGE-PARAMETERS.
          05  USER-PW               PIC X(21).
          05  FILLER                PIC X(1979).
  01  LOGICAL-CHANNEL          PIC XXX.
  01  DATA-LENGTH                      PIC 9(5) COMP.

  PROCEDURE DIVISION USING
            LOGICAL-CHANNEL
            DATA-LENGTH
            MESSAGE-BODY-IN
            MESSAGE-BODY-OUT
  START-HERE.
     MOVE SPACES TO OUTFILE-NAME.
     MOVE ZEROES TO REC-COUNT.
     MOVE ZEROES TO RET-STATUS.
  TRY-OPEN.
     IF CASE-NO NOT = "000000" GO TO TRY-CLOSE.
 *
 *    ORACLE LOGON
 *
```

```
      MOVE USER-PW TO USER-NAME.
     EXEC SQL CONNECT :USER-NAME  END-EXEC.
     IF SQLCODE = 0  GO TO END-CASE-CHECK.
      EXEC SQL CONNECT :OUNAM
         IDENTIFIED BY :OUPWD
         END-EXEC.
      IF SQLCODE <  0
         MOVE KES-OLOGON-ERROR TO RET-STATUS
         MOVE SQLCODE TO SHOW-RC
         STRING "BAD ORACLE LOGON:"           DELIMITED BY SIZE
                 SHOW-RC                      DELIMITED BY SIZE
         INTO MESG-DESC
         GO TO PGM-ABORT.
       GO TO END-CASE-CHECK.
   TRY-CLOSE.
      IF CASE-NO NOT = "CLS" GO TO TRY-BEGIN
      GO TO END-CASE-CHECK.
   TRY-BEGIN.
      IF CASE-NO NOT = "BEG" GO TO TRY-COMMIT.
      GO TO END-CASE-CHECK.
   TRY-COMMIT.
      IF CASE-NO NOT = "CMT"
         GO TO TRY-ROLLBACK.
      EXEC SQL
         COMMIT WORK
         END-EXEC.
      IF SQLCODE <  0
           MOVE KES-NOCOMMIT TO RET-STATUS
           MOVE SQLCODE TO SHOW-RC
           STRING "UNABLE TO COMMIT"           DELIMITED BY SIZE
                  SHOW-RC                      DELIMITED BY SIZE
                  INTO MESG-DESC
           GO TO PGM-ABORT
      ELSE
           GO TO END-CASE-CHECK.
   TRY-ROLLBACK.
      IF CASE-NO NOT = "RBK"
           GO TO END-FIXED-CASES.
      EXEC SQL ROLLBACK WORK                 END-EXEC.
      IF SQLCODE <  0
           MOVE KES-NOROLLBACK TO RET-STATUS
           MOVE SQLCODE TO SHOW-RC
           STRING "UNABLE TO ROLLBACK"          DELIMITED BY SIZE
                   SHOW-RC                      DELIMITED BY SIZE
                   INTO MESG-DESC
           GO TO PGM-ABORT
      ELSE
           GO TO END-CASE-CHECK.
  END-FIXED-CASES.
          MOVE CASE-NO TO RP-SUB-NAME.
      CALL RP-SUB-NAME USING  MESSAGE-BODY-IN
                              MESSAGE-BODY-OUT
      ON EXCEPTION
         MOVE KES-NO-RPSUB-ERROR TO RET-STATUS
         STRING " CANNOT CALL: "
              RP-SUB-NAME
              " CASE/SUB: "
               CASE-NO
              SUB-ID          DELIMITED BY SIZE
           INTO MESG-DESC
           GO TO PGM-ABORT.
      *
      * CALL WORKED --
      *
          MOVE QP-STATUS TO RET-STATUS.
          GO TO END-CASE-CHECK.
```

ORACLE REQUEST PROCESSOR MACROS

LIBRARY: ORACLE
MACRO: RPEND

```
  PGM-ABORT.
     MOVE ZERO TO REC-COUNT.
  END-CASE-CHECK.
     MOVE RET-STATUS TO QP-STATUS
     IF RET-STATUS NOT = ZEROES
         PERFORM PROCESS-ERROR.
     MOVE NTM-SOURCE TO NTM-DESTINATION.
     MOVE SPACES TO TIMEOUT-VALUE.
     MOVE "N" TO DATA-TYPE.
     CALL "NSEND" USING  NTM-DESTINATION,
                         LOGICAL-CHANNEL,
                         TIMEOUT-VALUE,
                         DATA-TYPE,
                         OUT-MESSAGE-TYPE,
                         MSG-OUT-L
                         MESSAGE-BODY-OUT
                         ACCEPT-STATUS,
     IF SEND-MSG-ACCEPTED
         IF CASE-NO  =  "CLS"
             GO TO PGM-END
         ELSE
             GO TO WAIT-HERE
     ELSE
         MOVE "RP CANNOT REPLY TO DRS" TO MESG-DESC
         PERFORM PROCESS-ERROR
         GO TO PGM-END.
  PGM-END.
*
*  TRMNAT DOES A COBOL STOP RUN
*
       CALL "TRMNAT"     USING    TERMINATION-STATUS.
*  INCLUDE THE ERRPRO OF IISSCLIB.
       COPY ERRPRO OF IISSCLIB.
```

ORACLE REQUEST PROCESSOR MACROS

```
LIBRARY:  ORACLE
  MACRO:  RPSTOP


 PGM-ABORT.
     MOVE ZERO TO REC-COUNT.
 END-CASE-CHECK.
     MOVE RET-STATUS TO QP-STATUS
     IF RET-STATUS NOT = ZEROES
          PERFORM PROCESS-ERROR.
     MOVE MSG-OUT-L TO DATA-LENGTH.
 PGM-END.
*
     EXIT PROGRAM.
 COPY ERRPRO OF IISSCLIB.
```

DB2 REQUEST PROCESSOR MACROS

LIBRARY: DB2
MACRO: RPSTART

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.  P1.
 ENVIRONMENT DIVISION.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  RET-STATUS                    PIC X(5).
 01  MODULE-NAME                   PIC X(10) VALUE IS "P1".
 01  MESG-DESC                     PIC X(60).
*    REPLY TO DRS
 01  MESSAGE-BODY-OUT.
    03  OUTFILE-NAME   PIC X(80).
    03  REC-COUNT                  PIC 9(6) VALUE ZERO.
    03  QP-STATUS                  PIC 9(5).
 01  MSG-OUT-L                     PIC 9(5) COMP VALUE 91.
*    NTM STUFF
 01  BUFFER            PIC X(4096).
 01  BUFFER-SIZE                   PIC 9(6) VALUE 4096.
 01  DATA-TYPE                     PIC X.
 01  NTM-DESTINATION   PIC X(10).
 01  LOGICAL-CHANNEL   PIC X(3).
 01  MESSAGE-TYPE                  PIC X(2).
 01  OUT-MESSAGE-TYPE  PIC XX VALUE "RR".
 01  MESSAGE-SERIAL-NUMBER         PIC X(7).
 01  NTM-SOURCE                    PIC X(10).
 01  TERMINATION-STATUS            PIC X  VALUE SPACE.
 01  TIMEOUT-VALUE                 PIC X(15) VALUE ZEROES.
 01  WAIT-FLAG                     PIC 9 VALUE 1.
 01  DATA-LENGTH                   PIC 9(5) COMP.
 COPY ERRCDM OF IISSCLIB.
 COPY CHKCDM OF IISSCLIB.
 COPY SRVRET OF IISSCLIB.
 01  SHOW-RC           PIC ----9.
*    MESSAGE FROM DRS
 01  MESSAGE-BODY-IN.
     03  CASE-NO                   PIC X(6).
     03  SUB-ID                    PIC XXX.
     03  MESSAGE-PARAMETERS PIC X(2000).
*   WS FOR DB2
01  DB2-PLAN-NAME        PIC X(8)  VALUE "P1".
01  DB2-RETURN-STATUS    PIC X(5)  VALUE SPACES.
01  DB2-TERMINATION-TYPE PIC X(4)  VALUE "ABRT".
    EXEC SQL INCLUDE SQLCA END-EXEC.
PROCEDURE DIVISION.
START-HERE.
    CALL "INITAL" USING BUFFER,
                        BUFFER-SIZE,
                        SYSTEM-STATE,
                        RET-CODE.
    IF INITAL-SUCCESSFUL
```

```
            NEXT SENTENCE
          ELSE
            MOVE "RP CANNOT START" TO MESG-DESC
            MOVE RET-CODE TO RET-STATUS
            PERFORM PROCESS-ERROR
            GO TO PGM-END.
      WAIT-HERE.
            MOVE SPACES TO OUTFILE-NAME.
            MOVE ZEROES TO REC-COUNT.
            MOVE SPACES TO LOGICAL-CHANNEL, NTM-SOURCE, MESSAGE-TYPE.
            CALL "RCV" USING LOGICAL-CHANNEL,
                             WAIT-FLAG,
                             NTM-SOURCE,
                             MESSAGE-TYPE
                             DATA-LENGTH,
                             MESSAGE-BODY-IN,
                             ACCEPT-STATUS,
                             MESSAGE-SERIAL-NUMBER.
            IF RCV-NORMAL-MESSAGE
              NEXT SENTENCE
            ELSE
              MOVE "UNABLE TO RECEIVE DRS REQUEST" TO MESG-DESC
              MOVE ACCEPT-STATUS TO RET-STATUS
              PERFORM PROCESS-ERROR
              GO TO PGM-ABORT.
            MOVE ZEROES TO RET-STATUS.
      TRY-OPEN.
              IF CASE-NO NOT = "000000" GO TO TRY-CLOSE.
             CALL "DB2OPN" USING DB2-PLAN-NAME,
                                 SQLCA,
                                 DB2-RETURN-STATUS.
            IF DB2-RETURN-STATUS = KES-SUCCESSFUL
                NEXT SENTENCE
            ELSE MOVE DB2-RETURN-STATUS TO RET-STATUS
               MOVE "DB2 OPEN ERROR" TO MESG-DESC
               PERFORM PROCES-ERROR
               GO TO PGM-ABORT.
            GO TO END-CASE-CHECK.
      TRY-CLOSE.
              IF CASE-NO NOT = "CLS" GO TO TRY-BEGIN.
             CALL "DB2CLS" USING DB2-TERMINATION-TYPE,
                                 DB2-RETURN-STATUS.
             IF DB2-RETURN-STATUS = KES-SUCCESSFUL
                NEXT SENTENCE
            ELSE MOVE DB2-RETURN-STATUS TO RET-STATUS
               MOVE "DB2 CLOSE ERROR" TO MESG-DESC
               PERFORM PROCESS-ERROR
               GO TO PGM-ABORT.
            GO TO END-CASE-CHECK.
      TRY-BEGIN.
             IF CASE-NO NOT = "BEG" GO TO TRY-COMMIT.
             GO TO END-CASE-CHECK.
      TRY-COMMIT.
             IF CASE-NO NOT = "CMT"
                GO TO TRY-ROLLBACK.
             EXEC SQL
                  COMMIT WORK
                  END-EXEC.
             IF SQLCODE <  0
          MOVE KES-NOCOMMIT TO RET-STATUS
          MOVE SQLCODE TO SHOW-RC
          STRING "UNABLE TO COMMIT"  DELIMITED BY SIZE
                 SHOW-RC             DELIMITED BY SIZE
                 INTO MESG-DESC
          GO TO PGM-ABORT
       ELSE
          GO TO END-CASE-CHECK.
TRY-ROLLBACK.
       IF CASE-NO NOT = "RBK"
          GO TO END-FIXED-CASES.
       EXEC SQL ROLLBACK WORK
          END-EXEC.
       IF SQLCODE <  0
          MOVE KES-NOROLLBACK TO RET-STATUS
          MOVE SQLCODE TO SHOW-RC
          STRING "UNABLE TO ROLLBACK"  DELIMITED BY SIZE
                 SHOW-RC               DELIMITED BY SIZE
                 INTO MESG-DESC
          GO TO PGM-ABORT
       ELSE
          GO TO END-CASE-CHECK.
   END-FIXED-CASES.
         MOVE CASE-NO TO RP-SUB-NAME.
      CALL RP-SUB-NAME USING MESSAGE-BODY-IN
                             MESSAGE-BODY-OUT
      ON EXCEPTION
        MOVE KES-NO-RPSUB-ERROR TO RET-STATUS
        STRING " CANNOT CALL: "
               RP-SUB-NAME
               " CASE/SUB: "
               CASE-NO
               SUB-ID     DELIMITED BY SIZE
        INTO MESG-DESC
         GO TO PGM-ABORT.
*
*   CALL WORKED --
*
    MOVE QP-STATUS TO RET-STATUS.
    GO TO END-CASE-CHECK.
```

DB2 REQUEST PROCESSOR MACROS

LIBRARY: DB2
MACRO: RPGO

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID. P1.
 ENVIRONMENT DIVISION.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  RET-STATUS              PIC X(5).
 01  MODULE-NAME             PIC X(10) VALUE IS "P1".
 01  MESG-DESC               PIC X(60).
 01  SHOW-RC         PIC ----9.
 01  RP-SUB-NAME         PIC X(6).
 01  MSG-OUT-L               PIC 9(5) COMP VALUE 91.
    COPY ERRCDM OF IISSCLIB.
    EXEC SQL INCLUDE SQLCA END-EXEC.
 01  DB2-PLAN-NAME       PIC X(8) VALUE "P1".
 01  DB2-RETURN-STATUS   PIC X(5)  VALUE SPACES.
 01  DB2-TERMINATION-TYPE  PIC X(4) VALUE "ABRT".
 LINKAGE-SECTION.
*    REPLY TO DRS
 01  MESSAGE-BODY-OUT.
    03  OUTFILE-NAME  PIC X(80).
    03  REC-COUNT             PIC 9(6).
    03  QP-STATUS             PIC X(5).
*   MESSAGE FROM DRS
 01  MESSAGE-BODY-IN.
    03  CASE-NO               PIC X(6).
    03  SUB-ID                PIC XXX.
    03  MESSAGE-PARAMETERS    PIC X(2000).
 01  LOGICAL-CHANNEL  PIC XXX.
 01  DATA-LENGTH              PIC 9(5) COMP.

 PROCEDURE DIVISION USING
           LOGICAL-CHANNEL
           DATA-LENGTH
           MESSAGE-BODY-IN
           MESSAGE-BODY-OUT.
 START-HERE.
    MOVE SPACES TO OUTFILE-NAME.
    MOVE ZEROES TO REC-COUNT.
    MOVE ZEROES TO RET-STATUS.
 TRY-OPEN.
     IF CASE-NO NOT = "000000" GO TO TRY-CLOSE.
     CALL "DB2OPN" USING DB2-PLAN-NAME,
                          SQLCA,
                       DB2-RETURN-STATUS.
     IF DB2-RETURN-STATUS = KES-SUCCESSFUL
        NEXT SENTENCE
     ELSE MOVE DB2-RETURN-STATUS TO RET-STATUS
       MOVE "LOCAL DB2 OPEN FAILURE" TO MESG-DESC
        PERFORM PROCESS-ERROR
        GO TO PGM-ABORT.
    GO TO END-CASE-CHECK.
```

```
TRY-CLOSE.
    IF CASE-NO NOT = "CLS" GO TO TRY-BEGIN.
   CALL "DB2CLS" USING DB2-TERMINATION-TYPE,
                       DB2-RETURN-STATUS.
    IF DB2-RETURN-STATUS = KES-SUCCESSFUL
       NEXT SENTENCE
    ELSE MOVE DB2-RETURN-STATUS TO RET-STATUS
      MOVE "LOCAL DB2 CLOSE FAILURE" TO MESG-DESC
       PERFORM PROCESS-ERROR
       GO TO PGM-ABORT.
   GO TO END-CASE-CHECK.
TRY-BEGIN.
    IF CASE-NO NOT = "BEG" GO TO TRY-COMMIT.
    GO TO END-CASE-CHECK.
TRY-COMMIT.
    IF CASE-NO NOT = "CMT"
         GO TO TRY-ROLLBACK.
    EXEC SQL
         COMMIT WORK
         END-EXEC.
    IF SQLCODE <  0
         MOVE KES-NOCOMMIT TO RET-STATUS
         MOVE SQLCODE TO SHOW-RC
         STRING "UNABLE TO COMMIT"          DELIMITED BY SIZE
                SHOW-RC                     DELIMITED BY SIZE
                INTO MESG-DESC
         GO TO PGM-ABORT
    ELSE
         GO TO END-CASE-CHECK.
TRY-ROLLBACK.
    IF CASE-NO NOT = "RBK"
         GO TO END-FIXED-CASES.
    EXEC SQL ROLLBACK WORK                END-EXEC.
    IF SQLCODE <  0
         MOVE KES-NOROLLBACK TO RET-STATUS
         MOVE SQLCODE TO SHOW-RC
         STRING "UNABLE TO ROLLBACK"    DELIMITED BY SIZE
                 SHOW-RC                DELIMITED BY SIZE
                 INTO MESG-DESC
         GO TO PGM-ABORT
    ELSE
         GO TO END-CASE-CHECK.
END-FIXED-CASES.
       MOVE CASE-NO TO RP-SUB-NAME.
   CALL RP-SUB-NAME USING MESSAGE-BODY-IN
                          MESSAGE-BODY-OUT
    ON EXCEPTION
       MOVE KES-NO-RPSUB-ERROR TO RET-STATUS
        STRING " CANNOT CALL: "
              RP-SUB-NAME
              " CASE/SUB: "
              CASE-NO
              SUB-ID     DELIMITED BY SIZE
        INTO MESG-DESC
       GO TO PGM-ABORT.
*
*     CALL WORKED--
```

```
      *
                 MOVE QP-STATUS TO RET-STATUS.
                 GO TO END-CASE-CHECK.
```

DB2 REQUEST PROCESSOR MACROS

LIBRARY: DB2
MACRO: RPEND

```
PGM-ABORT.
     MOVE ZERO TO REC-COUNT.
END-CASE-CHECK.
     MOVE RET-STATUS TO QP-STATUS
     IF RET-STATUS NOT = ZEROES
         PERFORM PROCESS-ERROR.
     MOVE NTM-SOURCE TO NTM-DESTINATION.
     MOVE SPACES TO TIMEOUT-VALUE.
     MOVE "N" TO DATA-TYPE.
     CALL "NSEND" USING  NTM-DESTINATION,
                         LOGICAL-CHANNEL,
                         TIMEOUT-VALUE,
                         DATA-TYPE,
                         OUT-MESSAGE-TYPE,
                         MSG-OUT-L
                         MESSAGE-BODY-OUT
                         ACCEPT-STATUS,
     IF SEND-MSG-ACCEPTED
         IF CASE-NO  =  "CLS"
             GO TO PGM-END
         ELSE
             GO TO WAIT-HERE
     ELSE
         MOVE "RP CANNOT REPLY TO DRS" TO MESG-DESC
         PERFORM PROCESS-ERROR
         GO TO PGM-END.
  PGM-END.
*

       CALL "TRMNAT"    USING    TERMINATION-STATUS.
       COPY ERRPRO OF IISSCLIB.
```

DB2 REQUEST PROCESSOR MACROS

LIBRARY: DB2
MACRO: RPSTOP

```
 PGM-ABORT.
    MOVE ZERO TO REC-COUNT.
 END-CASE-CHECK.
    MOVE RET-STATUS TO QP-STATUS
    IF RET-STATUS NOT = ZEROES
         PERFORM PROCESS-ERROR.
    MOVE MSG-OUT-L TO DATA-LENGTH.
 PGM-END.
*
    EXIT PROGRAM.
    COPY ERRPRO OF IISSCLIB.
```

TOTAL REQUEST PROCESSOR MACROS

LIBRARY: TOTAL
MACRO: RPSTART

```
IDENTIFICATION DIVISION.
PROGRAM-ID.  P1.
ENVIRONMENT DIVISION.
DATA DIVISION.
WORKING-STORAGE SECTION.
01  RET-STATUS                          PIC X(5).
01  MODULE-NAME                         PIC X(10) VALUE IS "P1".
01  MESG-DESC                           PIC X(60).
01  RP-SUB-NAME                     PIC X(6).
 *    REPLY TO DRS
01  MESSAGE-BODY-OUT.
       03  OUTFILE-NAME                 PIC X(80).
       03  REC-COUNT            PIC 9(6) VALUE ZERO.
       03  QP-STATUS            PIC 9(5).
01  MSG-OUT-L                           PIC 9(5) COMP VALUE 91.
 *    NTM STUFF
01  BUFFER                  PIC X(4096).
01  BUFFER-SIZE                         PIC 9(6) VALUE 4096.
01  DATA-TYPE                           PIC X.
01  NTM-DESTINATION         PIC X(10).
01  LOGICAL-CHANNEL         PIC X(3).
01  MESSAGE-TYPE            PIC X(2).
01  OUT-MESSAGE-TYPE        PIC XX VALUE "RR".
01  MESSAGE-SERIAL-NUMBER   PIC X(7).
01  NTM-SOURCE                          PIC X(10).
01  TERMINATION-STATUS                  PIC X  VALUE SPACE.
01  TIMEOUT-VALUE           PIC X(15) VALUE ZEROES.
01  WAIT-FLAG                           PIC 9 VALUE 1.
01  DATA-LENGTH                         PIC 9(5) COMP.
COPY ERRCDM OF IISSCLIB.
COPY CHKCDM OF IISSCLIB.
COPY SRVRET OF IISSCLIB.
 *      MESSAGE FROM DRS
01  MESSAGE-BODY-IN.
       03  CASE-NO                      PIC X(6).
       03  SUB-ID                       PIC XXX.
       03  MESSAGE-PARAMETERS PIC X(2000).
 *  WS FOR TOTAL
01  CLOSX                   PIC X(5)  VALUE "CLOSX".
01  SINON                   PIC X(5)  VALUE "SINON".
01  SINOF                   PIC X(5)  VALUE "SINOF".
01  ENDP                    PIC X(5)  VALUE "END".
01  COMIT                   PIC X(5)  VALUE "COMIT".
01  REST                    PIC X(5)  VALUE "RESET".
01  ASGN                    PIC X(4)  VALUE "ASGN".
*
*  TOTAL STATUS VALUES
*
01   TOTAL-STATUS           PIC X(4).
       88  SUCCESSFUL       VALUE "****".
       88  CONTROL-FIELD-BLANK      VALUE "BCTL".
```

```
          88  MASTER-NOT-FOUND              VALUE "MRNF".
          88  LINK-PATH-INVALID             VALUE "MLNF".
          88  FILE-ALREADY-OPEN   VALUE "DUPO".
          88  NO-SINOF-ISSUED     VALUE "EXSO".
    01  TOTAL-ACCESS              PIC X(6)  VALUE "UPDATE".
    01  DBMOD                     PIC X(8)  VALUE "P2".
    01  TASK                      PIC X(10) VALUE "P1".
    01  OPTIONS                   PIC X(14) VALUE "LOGOPTS=N,END".
    01  GLOBAL-REALM.
       03  FILLER                           PIC X(6)  VALUE "REALM=".
       03  FILLER                           PIC X(13) OCCUR 40 TIMES.
       03  FILLER                           PIC X(4)  VALUE "END".
       03  REALM-FILE-COUNT                 PIC 99.
    01  COMIT-LENGTH              PIC X(4)  VALUE LOW-VALUES.
    01  COMIT-DATA-AREA           PIC X     VALUE SPACE.
    01  RESET-LENGTH              PIC X(4)  VALUE LOW-VALUES.
    01  RESET-DATA-AREA           PIC X     VALUE SPACE.
    PROCEDURE DIVISION.
    START-HERE.
          MOVE "REALM=END." TO GLOBAL-REALM.
          MOVE 0 TO REALM-FILE-COUNT.
          CALL "INITAL" USING BUFFER,
                              BUFFER-SIZE,
                              SYSTEM-STATE,
                              RET-CODE.
          IF INITAL-SUCCESSFUL
             NEXT SENTENCE
          ELSE
             MOVE "RP CANNOT START" TO MESG-DESC
             MOVE RET-CODE TO RET-STATUS
             PERFORM PROCESS-ERROR
             GO TO PGM-END.
        WAIT-HERE.
             MOVE SPACES TO OUTFILE-NAME.
             MOVE ZEROES TO REC-COUNT.
             MOVE SPACES TO LOGICAL-CHANNEL, NTM-SOURCE,
  MESSAGE-TYPE.
             CALL "RCV" USING LOGICAL-CHANNEL,
                              WAIT-FLAG,
                              NTM-SOURCE,
                              MESSAGE-TYPE
                              DATA-LENGTH,
                              MESSAGE-BODY-IN,
                              ACCEPT-STATUS,
                              MESSAGE-SERIAL-NUMBER.
             IF RCV-NORMAL-MESSAGE
                NEXT SENTENCE
             ELSE
                MOVE "UNABLE TO RECEIVE DRS REQUEST" TO MESG-DESC
                MOVE ACCEPT-STATUS TO RET-STATUS
                PERFORM PROCESS-ERROR
                GO TO PGM-ABORT.
             MOVE ZEROES TO RET-STATUS.
    TRY-OPEN.
          IF CASE-NO NOT = "000000" GO TO TRY-CLOSE.
     *
     *    TOTAL INITIATION
     *
          CALL "DATBAS" USING SINON,
                                    TOTAL-STATUS,
                                    TOTAL-ACCESS,
                                    DBMOD,
                                    TASK,
                                    OPTIONS,
                                    ENDP.
              IF SUCCESSFUL
                 GO TO END-CASE-CHECK
              ELSE
                 MOVE KES-TOTAL-SINON-FAILED TO RET-STATUS
                 STRING "TOTAL SINON FAILED WITH STATUS-"
                               DELIMITED BY SIZE
                       TOTAL-STATUS DELIMITED BY SIZE
                               INTO MESG-DESC
                 GO TO PGM-ABORT.
          TRY-CLOSE.
              IF CASE-NO NOT = "CLS" GO TO TRY-COMMIT.
                 CALL "DATBAS" USING CLOSX,
                                     TOTAL-STATUS,
                                     GLOBAL-REALM,
                                     ENDP.
              IF SUCCESSFUL
                 NEXT SENTENCE
              ELSE
                 MOVE KES-TOTAL-CLOSX-FAILED TO RET-STATUS
                 STRING "TOTAL CLOSE FAILED WITH STATUS-"
                               DELIMITED BY SIZE
                       TOTAL-STATUS DELIMITED BY SIZE
                               INTO MESG-DESC
                 GO TO PGM-ABORT.
              CALL "DATBAS" USING SINOF,
                                  TOTAL-STATUS,
                                  TASK,
                                  ENDP.
              IF SUCCESSFUL
                 NEXT SENTENCE
              ELSE
                 MOVE KES-TOTAL-SINOF-FAILED TO RET-STATUS
                 STRING "TOTAL SINOF FAILED WITH STATUS-"
                              DELIMITED BY SIZE
                       TOTAL-STATUS DELIMITED BY SIZE
                              INTO MESG-DESC.
          TRY-COMMIT.
              IF CASE-NO NOT = "CMT"
                 GO TO TRY-ROLLBACK.
              CALL "DATBAS" USING COMIT,
                              TOTAL-STATUS,
                              ASGN,
                              COMMIT-LENGTH,
                              COMMIT-DATA-AREA,
                              ENDP.
              IF SUCCESSFUL
                 GO TO END-CASE-CHECK
              ELSE
                 MOVE KES-TOTAL-COMIT-FAILED TO RET-STATUS
                 STRING "TOTAL COMIT FAILED WITH STATUS OF"
                                      DELIMITED BY SIZE
                     TOTAL-STATUS    DELIMITED BY SIZE
                 INTO MESG-DESC
              GO TO PGM-ABORT.
       TRY-ROLLBACK.
           IF CASE-NO NOT = "RBK"
              GO TO END-FIXED-CASES.
           CALL "DATBAS" USING REST,
                               TOTAL-STATUS,
                               ASGN,
                               RESET-LENGTH
                               RESET-DATA-AREA,
                               ENDP.
           IF SUCCESSFUL
              GO TO END-CASE-CHECK
           ELSE
              MOVE KES-TOTAL-RESET-FAILED TO RET-STATUS
              STRING "TOTAL RESET FAILED WITH STATUS OF"
                                          DELIMITED BY SIZE
                   TOTAL-STATUS           DELIMITED BY SIZE
              INTO MESG-DESC
              GO TO PGM-ABORT.
        END-FIXED-CASES.
            MOVE CASE-NO TO RP-SUB-NAME.
        CALL RP-SUB-NAME USING MESSAGE-BODY-IN
               MESSAGE-BODY-OUT
        ON EXCEPTION
            MOVE KES-NO-RPSUB-ERROR TO RET-STATUS
            STRING " CANNOT CALL: "
             RP-SUB-NAME
             " CASE/SUB: "
             CASE-NO
             SUB-ID        DELIMITED BY SIZE
            INTO MESG-DESC
            GO TO PGM-ABORT.
  *
  *    CALL WORKED--
  *
          MOVE QP-STATUS TO RET-STATUS.
        GO TO END-CASE-CHECK.
```

LIBRARY: TOTAL
MACRO: RPGO

```
IDENTIFICATION DIVISION.
PROGRAM-ID.  P1.
ENVIRONMENT DIVISION.
DATA DIVISION.
WORKING-STORAGE SECTION.
01  RET-STATUS        PIC X(5).
01  MODULE-NAME       PIC X(10) VALUE IS "P1".
01  MESG-DESC         PIC X(60).
  01  RP-SUB-NAME PIC X(6).
        COPY ERRCDM OF IISSCLIB.
 *    WS FOR TOTAL
01  CLOSX     PIC X(5) VALUE "CLOSX".
01  SINON     PIC X(5) VALUE "SINON".
01  SINOF     PIC X(5) VALUE "SINOF".
01  ENDP      PIC X(5) VALUE "END.".
01  COMIT     PIC X(5) VALUE "COMIT".
01  REST      PIC X(5) VALUE "RESET".
01  ASGN          PIC X(4) VALUE "ASGN".
*
*    TOTAL STATUS VALUES
*
01  TOTAL-STATUS              PIC X(4).
      88  SUCCESSFUL          VALUE "****".
      88  CONTROL-FIELD-BLANK      VALUE "BCTL".
      88  MASTER-NOT-FOUND         VALUE "MRNF".
      88  LINK-PATH-INVALID        VALUE "MLNF".
      88  FILE-ALREADY-OPEN   VALUE "DUPO"
      88  NO-SINOF-ISSUED             VALUE "EXSO".
*
01  TOTAL-ACCESS              PIC X(6) VALUE "UPDATE".
01  DBMOD                     PIC X(8)  VALUE "P2".
01  TASK                      PIC X (10) VALUE "P1".
01  OPTIONS                   PIC X(14) VALUE "LOGOPTS=N,END".
01  GLOBAL-REALM.
      03  FILLER                      PIC X(6) VALUE "REALM=".
      03  FILLER                      PIC X(13) OCCURS 40
TIMES.
      03  FILLER                      PIC X(4)  VALUE "END.".
      03  REALM-FILE-COUNT    PIC 99.
01   COMIT-LENGTH             PIC X(4) VALUE LOW-VALUES.
01   COMIT-DATA-AREA          PIC X    VALUE SPACE.
01   RESET-LENGTH             PIC X (4) VALUE LOW-VALUES.
01   RESET-DATA-AREA          PIC X     VALUE SPACE.
01   MSG-OUT-L                        PIC S9(5) COMP VALUE 91.
LINKAGE SECTION.
01   MESSAGE-BODY-IN.
       03  CASE-NO            PIC X(6).
       03  SUB-ID                     PIC XXX.
       03  MESSAGE-PARAMETERS         PIC X(2000).
01   MESSAGE-BODY-OUT.
       03  OUTFILE-NAME               PIC X(80).
       03  REC-COUNT                 PIC 9(6).
       03  QP-STATUS            PIC X(5).
01   DATA-LENGTH                PIC S9(5) COMP.
01   LOGICAL-CHANNEL            PIC X(3).

  PROCEDURE DIVISION USING
                   LOGICAL-CHANNEL
                   DATA-LENGTH
                   MESSAGE-BODY-IN
                   MESSAGE-BODY-OUT.
  START-HERE
    MOVE SPACES TO OUTFILE-NAME.
    MOVE ZEROES TO REC-COUNT.
    MOVE ZEROES TO RET-STATUS.
  TRY-OPEN.
    IF CASE-NO NOT = "000000" GO TO TRY-CLOSE.
*
*   TOTAL INITIALIZATION
*
       MOVE "REALM=END." TO GLOBAL-REALM.
       MOVE 0 TO REALM-FILE-COUNT.
       CALL "DATBAS" USING SINON,
                        TOTAL-STATUS,
                        TOTAL-ACCESS,
                        DBMOD,
                        TASK,
                        OPTIONS,
                        ENDP.
      IF SUCCESSFUL
          GO TO END-CASE-CHECK
      ELSE
         MOVE KES-TOTAL-SINON-FAILED TO RET-STATUS
         STRING "TOTAL SINON FAILED WITH STATUS-"
                 DELIMITED BY SIZE
               TOTAL-STATUS DELIMITED BY SIZE
                 INTO MESG-DESC
        GO TO PGM-ABORT.
   TRY-CLOSE.
      IF CASE-NO NOT = "CLS" GO TO TRY-COMMIT.
          CALL "DATBAS" USING CLOSX,
                            TOTAL-STATUS,
                            GLOBAL-REALM,
                            ENDP.
     IF SUCCESSFUL
        NEXT SENTENCE
     ELSE
         MOVE KES-TOTAL-CLOSX-FAILED TO RET-STATUS
         STRING "TOTAL CLOSE FAILED WITH STATUS-"
                   DELIMITED BY SIZE
                   TOTAL-STATUS DELIMITED BY SIZE
                   INTO MESG-DESC
              GO TO PGM-ABORT.
        CALL "DATBAS" USING SINOF,
                          TOTAL-STATUS,
                          TASK,
                          ENDP.
      IF SUCCESSFUL
         NEXT SENTENCE
      ELSE
```

```
          MOVE KES-TOTAL-SINOF-FAILED TO RET-STATUS
          STRING "TOTAL SINOF FAILED WITH STATUS-"
                   DELIMITED BY SIZE
                   TOTAL-STATUS DELIMITED BY SIZE
                   INTO MESG-DESC
         GO TO PGM-ABORT.
    TRY-COMMIT.
        IF CASE-NO NOT = "CMT"
            GO TO TRY-ROLLBACK.
        CALL "DATBAS" USING COMIT,
                        TOTAL-STATUS
                        ASGN,
                        COMIT-LENGTH,
                        COMIT-DATA-AREA,
                        ENDP.
       IF SUCCESSFUL
           GO TO END-CASE-CHECK
       ELSE
            MOVE KES-TOTAL-COMIT-FAILED TO RET-STATUS
            STRING "TOTAL COMIT FAILED WITH STATUS OF"
                    DELIMITED BY SIZE
                    TOTAL-STATUS DELIMITED BY SIZE
           INTO MESG-DESC
        GO TO PGM-ABORT
   TRY-ROLLBACK.
       IF CASE-NO NOT = "RBK"
            GO TO END-FIXED-CASES.
       CALL "DATBAS" USING REST,
                        TOTAL-STATUS,
                        ASGN,
                        RESET-LENGTH,
                        RESET-DATA-AREA,
                        ENDP.
        IF SUCCESSFUL
           GO TO END-CASE-CHECK
        ELSE
            MOVE KES-TOTAL-RESET-FAILED TO RET-STATUS
            STRING "TOTAL RESET FAILED WITH STATUS OF"
                    DELIMITED BY SIZE
                    TOTAL-STATUS DELIMITED BY SIZE
            INTO MESG-DESC
            GO TO PGM-ABORT.
   END-FIXED-CASES.
        MOVE CASE-NO TO RP-SUB-NAME.
     CALL RP-SUB-NAME USING MESSAGE-BODY-IN
            MESSAGE-BODY-OUT
       ON EXCEPTION
        MOVE KES-NO-RPSUB-ERROR TO RET-STATUS
          STRING " CANNOT CALL: "
         RP-SUB-NAME
         " CASE/SUB: "
         CASE-NO
         SUB-ID       DELIMITED BY SIZE
        INTO MESG-DESC
        GO TO PGM-ABORT.
*
*   CALL WORKED--
```

```
*
           MOVE QP-STATUS TO RET-STATUS.
           GO TO END-CASE-CHECK.
```

TOTAL REQUEST PROCESSOR MACROS

```
LIBRARY:  TOTAL
  MACRO:  RPEND


PGM-ABORT.
    MOVE ZERO TO REC-COUNT.
END-CASE-CHECK.
    MOVE RET-STATUS TO QP-STATUS.
    IF RET-STATUS NOT = ZEROES
        PERFORM PROCESS-ERROR.
    MOVE NTM-SOURCE TO NTM-DESTINATION.
    MOVE SPACES TO TIMEOUT-VALUE.
    MOVE "N" TO DATA-TYPE.
    CALL "NSEND" USING  NTM-DESTINATION,
                        LOGICAL-CHANNEL,
                        TIMEOUT-VALUE,
                        DATA-TYPE,
                        OUT-MESSAGE-TYPE,
                        MSG-OUT-L
                        MESSAGE-BODY-OUT
                        ACCEPT-STATUS.
    IF SEND-MSG-ACCEPTED
        IF CASE-NO = "CLS"
           GO TO PGM-END
        ELSE
           GO TO WAIT-HERE
    ELSE
        MOVE "RP CANNOT REPLY TO DRS" TO MESG-DESC
        PERFORM PROCESS-ERROR
        GO TO PGM-END.
PGM-END.
*
*   TRMNAT DOES A COBOL STOP RUN
*
        CALL "TRMNAT" USING TERMINATION-STATUS.
*
*   INCLUDE THE ERRPRO OF IISSCLIB.
*
        COPY ERRPRO OF IISSCLIB.
```

```
LIBRARY:  TOTAL
  MACRO:  RPSTOP

PGM-ABORT.
    MOVE ZERO TO REC-COUNT.
END-CASE-CHECK.
    MOVE RET-STATUS TO QP-STATUS.
    IF RET-STATUS NOT = ZEROES
         PERFORM PROCESS-ERROR.
    MOVE MSG-OUT-L TO DATA-LENGTH.
PGM-END.
*
    EXIT PROGRAM.
COPY ERRPRO OF IISSCLIB.
```

LIBRARY: VAX11
MACRO: RPSTART

```
   IDENTIFICATION DIVISION.
   PROGRAM-ID.  P1.
   ENVIRONMENT DIVISION.
   DATA DIVISION.
*
   SUB-SCHEMA SECTION.
   DB P6 WITHIN P3
   FOR "P5".
   WORKING-STORAGE SECTION.
   01  RET-STATUS                PIC X(5).
   01  MODULE-NAME               PIC X(8) VALUE  "P1".
   01  MESG-DESC                 PIC X(60).
   01  RP-SUB-NAME            PIC X(6).
  *    REPLY TO DRS
   01  MESSAGE-BODY-OUT.
      03  OUTFILE-NAME        PIC X(80).
      03  REC-COUNT           PIC 9(6) VALUE ZERO.
      03  QP-STATUS           PIC 9(5).
   01  MSG-OUT-L                 PIC 9(5) COMP VALUE 91.
  *    NTM STUFF
   01  BUFFER                    PIC X(4096).
   01  BUFFER-SIZE               PIC 9(6) VALUE 4096.
   01  DATA-TYPE                 PIC X.
   01  NTM-DESTINATION  PIC X(10).
   01  LOGICAL-CHANNEL  PIC X(3).
   01  MESSAGE-TYPE              PIC X(2).
   01  OUT-MESSAGE-TYPE PIC XX VALUE "RR".
   01  MESSAGE-SERIAL-NUMBER PIC X(7).
   01  NTM-SOURCE                PIC X(10).
   01  TERMINATION-STATUS        PIC X   VALUE SPACE.
   01  TIMEOUT-VALUE          PIC X(15) VALUE ZEROES.
   01  WAIT-FLAG        PIC 9 VALUE 1.
   01  DATA-LENGTH               PIC 9(5) COMP.
   COPY CHKCDM OF IISSCLIB.
   COPY SRVRET OF IISSCLIB.
  *    MESSAGE FROM DRS
   01  MESSAGE-BODY-IN.
      03  CASE-NO                PIC X(6).
      03  SUB-ID                 PIC XXX.
      03  MESSAGE-PARAMETERS     PIC X(2000).
  *    WS FOR VAX-11
   01  DBMS-STATUS               PIC S9(9).
       88  EOA  VALUE 2654548.
       88  EOS  VALUE 2654548.
       88  EOC  VALUE 2654548
       88  EOO  VALUE 2654548.
       88  OK-STATUS VALUE 1.
       88  OK VALUE 1 2654548.
       88  NON-FATAL VALUE  2654548 1.
   01  DISP-STATUS               PIC ---------9.
   PROCEDURE DIVISION.
   DECLARATIVES.
   DB-DATABASE-EXCEPTIONS SECTION.
      USE FOR DB-EXCEPTION.
   DB-ERROR-ROUTINE.
   END DECLARATIVES.
   START-PROGRAM SECTION.
   START-HERE.
       CALL "LOCKEF".
       CALL "INITAL" USING BUFFER,
                           BUFFER-SIZE,
                           SYSTEM-STATE,
                           RET-CODE.
       IF INITAL-SUCCESSFUL
         NEXT SENTENCE
       ELSE
         MOVE "RP CANNOT START" TO MESG-DESC
         MOVE RET-CODE TO RET-STATUS
         PERFORM PROCESS-ERROR
         GO TO PGM-END.
   WAIT-HERE.
         MOVE SPACES TO OUTFILE-NAME.
         MOVE ZEROES TO REC-COUNT.
         MOVE SPACES TO LOGICAL-CHANNEL, NTM-SOURCE,
 MESSAGE-TYPE.
         CALL "RCV" USING LOGICAL-CHANNEL,
                          WAIT-FLAG,
                          NTM-SOURCE,
                          MESSAGE-TYPE,
                          DATA-LENGTH,
                          MESSAGE-BODY-IN,
                          ACCEPT-STATUS,
                          MESSAGE-SERIAL-NUMBER.
         IF RCV-NORMAL-MESSAGE
            NEXT SENTENCE
         ELSE
            MOVE "UNABLE TO RECEIVE DRS REQUEST" TO MESG-DESC
            MOVE ACCEPT-STATUS TO RET-STATUS
            PERFORM PROCESS-ERROR
            GO TO PGM-ABORT.
         MOVE ZEROES TO RET-STATUS.
   TRY-OPEN.
         IF CASE-NO NOT = "000000" GO TO TRY-CLOSE.
  *
  *           VAX-11 INITIALIZATION
  *
         READY CONCURRENT UPDATE.
         PERFORM VAX-11-STATUS.
         IF NOT OK
            MOVE KES-VAX11-READY-FAILED TO RET-STATUS
            STRING "VAX-11 READY FAILED"        DELIMITED BY SIZE
                    DISP-STATUS                 DELIMITED BY SIZE
                    INTO MESG-DESC
            GO TO PGM-ABORT
         ELSE
            GO TO END-CASE-CHECK.
   TRY-CLOSE.
         IF CASE-NO NOT = "CLS" GO TO TRY-COMMIT.
  *      FINISH.
```

```
        PERFORM VAX-11-STATUS.
        IF NOT OK
           MOVE KES-VAX11-FINISH-FAILED TO RET-STATUS
                STRING "VAX-11 FINISH FAILED"   DELIMITED BY
SIZE
                DISP-STATUS      DELIMITED BY SIZE INTO
MESG-DESC
           GO TO PGM-ABORT
        ELSE
           GO TO END-CASE-CHECK.
  TRY COMMIT.
        IF CASE-NO NOT = "CMT"
             GO TO TRY-BEGIN.
        COMMIT.
        PERFORM VAX-11-STATUS.
        IF NOT OK
           MOVE KES-VAX11-COMMIT-FAILED TO RET-STATUS
           STRING "VAX-11 COMMIT FAILED"        DELIMITED BY SIZE
           DISP-STATUS                          DELIMITED BY SIZE

           INTO MESG-DESC
             GO TO PGM-ABORT
        ELSE
             GO TO END-CASE-CHECK.
  TRY-BEGIN.
        IF CASE-NO NOT = "BEG" GO TO TRY-ROLLBACK.
        READY CONCURRENT UPDATE.
        PERFORM VAX-11-STATUS.
        IF NOT OK
           MOVE KES-VAX11-READY-FAILED TO RET-STATUS
           STRING "VAX-11 READY FAILED" DISP-STATUS
           DELIMITED BY SIZE INTO MESG-DESC
           GO TO PGM-ABORT
        ELSE
           GO TO END-CASE-CHECK.
  TRY-ROLLBACK.
        IF CASE-NO NOT = "RBK"
           GO TO END-FIXED-CASES.
        ROLLBACK.
        PERFORM VAX-11-STATUS.
        IF NOT OK
           MOVE KES-VAX11-ROLLBACK-FAILED TO RET-STATUS
           STRING "VAX-11-ROLLBACK FAILED" DELIMITED BY SIZE
           DISP-STATUS                        DELIMITED BY SIZE
                INTO MESG-DESC
           GO TO PGM-ABORT
        ELSE
           GO TO END-CASE-CHECK.
  VAX-11-STATUS.
        MOVE DB-CONDITION TO DBMS-STATUS, DISP-STATUS.
  END-FIXED-CASES.
        MOVE CASE-NO TO RP-SUB-NAME.
      CALL RP-SUB-NAME USING MESSAGE-BODY-IN
                   MESSAGE-BODY-OUT
      ON EXCEPTION
        MOVE KES-NO-RPSUB-ERROR TO RET-STATUS
        STRING " CANNOT CALL: "
           RP-SUB-NAME
           " CASE/SUB: "
```

```
              CASE-NO
              SUB-ID       DELIMITED BY SIZE
           INTO MESG-DESC
           GO TO PGM-ABORT.
*
*   CALL WORKED--
*
         MOVE QP-STATUS TO RET-STATUS.
         GO TO END-CASE-CHECK.
```

VAX-11 REQUEST PROCESSOR MACROS

LIBRARY: VAX-11
MACRO: RPGO

```
  IDENTIFICATION DIVISION.
  PROGRAM-ID. P1.
  ENVIRONMENT DIVISION.
  DATA DIVISION.
*
  SUB-SCHEMA SECTION.
  DB  P6  WITHIN  P3
  FOR "P5".
  WORKING-STORAGE SECTION.
  01  RET-STATUS          PIC X(5).
  01  MODULE-NAME         PIC X(8) VALUE "P1".
  01  MESG-DESC           PIC X(60).
  01  MSG-OUT-L           PIC 9(5) COMP VALUE 91.
  01  RP-SUB-NAME   PIC X(6).
  COPY ERRCDM OF IISSCLIB.
 *                     WS FOR VAX-11
  01  DBMS-STATUS         PIC S9(9).
    88  EOA  VALUE 2654548.
    88  EOS  VALUE 2654548.
    88  EOC  VALUE 2654548.
    88  EOO  VALUE 2654548.
    88  OK-STATUS  VALUE 1.
    88  OK   VALUE 1 2654548.
    88  NON-FATAL  VALUE 2654548 1.
  01  DISP-STATUS     PIC ---------9.
  LINKAGE SECTION.
  01  MESSAGE-BODY-OUT.
     03  OUTFILE-NAME          PIC X(80).
     03  REC-COUNT                  PIC 9(6).
     03  QP-STATUS                  PIC X(5).
  01  MESSAGE-BODY-IN
     03  CASE-NO                          PIC X(6).
     03  SUB-ID                           PIC XXX.
     03  MESSAGE-PARAMETERS               PIC X(2000).
  01  LOGICAL-CHANNEL          PIC X(3).
  01  DATA-LENGTH                         PIC S9(5) COMP.
  PROCEDURE DIVISION USING
            LOGICAL-CHANNEL
            DATA-LENGTH
            MESSAGE-BODY-IN
            MESSAGE-BODY-OUT.
  DECLARATIVES.
  DB-DATABASE-EXCEPTIONS SECTION.  USE FOR DB-EXCEPTION.
  DB-ERROR-ROUTINE.
  END DECLARATIVES.
  START-PROGRAM SECTION.
  START-HERE.
      MOVE SPACES TO OUTFILE-NAME.
      MOVE ZEROES TO REC-COUNT.
      MOVE ZEROES TO RET-STATUS.
  TRY-OPEN.
```

```
           IF CASE-NO NOT = "000000" GO TO TRY-CLOSE.
      *
      *    VAX-11  INITIALIZATION
      *
           READY          CONCURRENT UPDATE.
           PERFORM VAX-11-STATUS.
           IF NOT OK
              MOVE KES-VAX11-READY-FAILED TO RET-STATUS
              STRING "VAX-11 READY FAILED"       DELIMITED BY SIZE
                     DISP-STATUS                 DELIMITED BY SIZE
                     INTO MESG-DESC
              GO TO PGM-ABORT
           ELSE
              GO TO END-CASE-CHECK.
       TRY-CLOSE.
           IF CASE-NO NOT = "CLS" GO TO TRY-COMMIT.
      *       FINISH.
           PERFORM VAX-11-STATUS.
           IF NOT OK
              MOVE KES-VAX11-FINISH-FAILED TO RET-STATUS
              STRING "VAX-11 FINISH FAILED"     DELIMITED BY SIZE
                     DISP-STATUS                DELIMITED BY SIZE
                     INTO MESG-DESC
              GO TO PGM-ABORT
           ELSE
              GO TO END-CASE-CHECK.
       TRY-COMMIT.
           IF CASE-NO NOT = "CMT"
              GO TO TRY-BEGIN.
           COMMIT.
           PERFORM VAX-11-STATUS.
           IF NOT OK
              MOVE KES-VAX11-COMMIT-FAILED TO RET-STATUS
              STRING "IDMS COMMIT FAILED"       DELIMITED BY SIZE
                      DISP-STATUS                DELIMITED BY SIZE
                      INTO MESG-DESC
              GO TO PGM-ABORT
           ELSE
              GO TO END-CASE-CHECK.
       TRY-BEGIN.
           IF CASE-NO NOT = "BEG"  GO TO TRY-ROLLBACK.
           READY CONCURRENT UPDATE.
           PERFORM VAX-11-STATUS.
           IF NOT OK
              MOVE KES-VAX11-READY-FAILED TO RET-STATUS
              STRING "VAX-11 READY FAILED" DELIMITED BY SIZE
              DISP-STATUS             DELIMITED BY SIZE
              INTO MESG-DESC
              GO TO PGM-ABORT
           ELSE
              GO TO END-CASE-CHECK.
       TRY-ROLLBACK.
           IF CASE-NO NOT = "RBK"
              GO TO END-FIXED-CASES.
           ROLLBACK.
           PERFORM VAX-11-STATUS.
           IF NOT OK
              MOVE KES-VAX11-ROLLBACK-FAILED TO RET-STATUS
              STRING "VAX-11 ROLLBACK FAILED"  DELIMITED BY SIZE
```

```
          DISP-STATUS                         DELIMITED BY SIZE
          INTO MESG-DESC
          GO TO PGM-ABORT
       ELSE
          GO TO END-CASE-CHECK.
   VAX-11-STATUS.
       MOVE DB-CONDITION TO DBMS-STATUS, DISP-STATUS.
   END-FIXED-CASES.
          MOVE CASE-NO TO RP-SUB-NAME.
       CALL RP-SUB-NAME USING MESSAGE-BODY-IN
                 MESSAGE-BODY-OUT
       ON EXCEPTION
          MOVE KES-NO-RPSUB-ERROR TO RET-STATUS
          STRING " CANNOT CALL: "
            RP-SUB-NAME
                 " CASE/SUB: "
            CASE-NO
            SUB-ID        DELIMITED BY SIZE
          INTO MESG-DESC
          GO TO PGM-ABORT.
 *  CALL WORKED--
 *
          MOVE QP-STATUS TO RET-STATUS.
          GO TO END-CASE-CHECK.
```

VAX-11 REQUEST PROCESSOR MACROS

LIBRARY: VAX-11
MACRO: RPEND

```
     PGM-ABORT.
     MOVE ZERO TO REC-COUNT.
     END-CASE-CHECK.
     MOVE RET-STATUS TO QP-STATUS
     IF RET-STATUS NOT = ZEROES
           PERFORM PROCESS-ERROR.
     MOVE NTM-SOURCE TO NTM-DESTINATION.
     MOVE SPACES TO TIMEOUT-VALUE.
     MOVE "N" TO DATA-TYPE.
     CALL "NSEND" USING  NTM-DESTINATION,
                        LOGICAL-CHANNEL,
                        TIMEOUT-VALUE,
                        DATA-TYPE,
                        OUT-MESSAGE-TYPE,
                        MSG-OUT-L
                        MESSAGE-BODY-OUT
                        ACCEPT-STATUS.
    IF SEND-MSG-ACCEPTED
        IF CASE-NO  =  "CLS"
               GO TO PGM-END
        ELSE
               GO TO WAIT-HERE
    ELSE
           MOVE "RP CANNOT REPLY TO DRS" TO MESG-DESC
           PERFORM PROCESS-ERROR
           GO TO PGM-END.
 PGM-END.
*
*  TRMNAT DOES A COBOL STOP RUN
*
      CALL "TRMNAT"    USING    TERMINATION-STATUS.
*
*  INCLUDE THE ERRPRO OF IISSCLIB.
*
      COPY ERRPRO OF IISSCLIB.
```

VAX-11 REQUEST PROCESSOR MACROS

LIBRARY: VAX-11
MACRO: RPSTOP

```
PGM-ABORT.
MOVE ZERO TO REC-COUNT.
END-CASE-CHECK.
MOVE RET-STATUS TO QP-STATUS.
IF RET-STATUS NOT = ZEROES
     PERFORM PROCESS-ERROR.
MOVE MSG-OUT-L TO DATA-LENGTH.
PGM-END.
 EXIT PROGRAM.
 COPY ERRPRO OF IISSCLIB.
```

LIBRARY: IDMS
MACRO: RPSTART

```
           IDENTIFICATION DIVISION.
           PROGRAM-ID.  P1.
           ENVIRONMENT DIVISION.
           IDMS-CONTROL SECTION.
           PROTOCOL.   MODE IS BATCH DEBUG
             IDMS-RECORDS WITHIN WORKING-STORAGE SECTION.
           DATA DIVISION.
      *
           SCHEMA SECTION.
           DB P6 WITHIN P3.
        WORKING-STORAGE SECTION.
YANKME*01  INPUT-CARD            PIC X(80).
       01  RET-STATUS         PIC X(5).
       01  MODULE-NAME        PIC X(8) VALUE  "P1".
       01  MESG-DESC          PIC X(60).
       01  RP-SUB-NAME        PIC X(6).
      *    REPLY TO DRS
       01  MESSAGE-BODY-OUT.
            03  OUTFILE-NAME    PIC X(80).
            03  REC-COUNT       PIC 9(6) VALUE ZERO.
            03  QP-STATUS       PIC 9(5).
            01  MSG-OUT-L            PIC 9(5) COMP VALUE 91.
      *    NTM STUFF
       01  BUFFER       PIC X(4096).
       01  BUFFER-SIZE PIC 9(6) VALUE 4096.
       01  DATA-TYPE    PIC X.
       01  NTM-DESTINATION     PIC X(10).
       01  LOGICAL-CHANNEL     PIC X(3).
       01  MESSAGE-TYPE        PIC X(2).
       01  OUT-MESSAGE-TYPE    PIC XX VALUE "RR".
       01  MESSAGE-SERIAL-NJMBER        PIC X(7).
       01  NTM-SOURCE  PIC X(10).
       01  TERMINATION-STATUS  PIC X   VALUE SPACE.
       01  TIMEOUT-VALUE       PIC X(15) VALUE ZEROES.
       01  WAIT-FLAG    PIC 9 VALUE 1.
       01  DATA-LENGTH PIC 9(5) COMP.
KEEPME*COPY ERRCDM OF IISSCLIB.
KEEPME*COPY CHKCDM OF IISSCLIB.
KEEPME*COPY SRVRET OF IISSCLIB..
      *    MESSAGE FROM DRS
       01  MESSAGE-BODY-IN.
            03  CASE-NO         PIC X(6).
            03  SUB-ID PIC XXX.
            03  MESSAGE-PARAMETERS     PIC X(2000).
      *                        WS FOR IDMS
       01  DBMS-STATUS              PIC (4).
           88  EOA  VALUE "0307".
           88  EOS  VALUE "0307".
           88  EOC  VALUE "0364" "0326" "0332".
           88  EOO  VALUE "0307".
           88  OK-STATUS VALUE "0000".
```

```
            88  OK VALUES  "0307" "0364" "0326" "0332" "0000".
            88  NON-FATAL VALUES  "0307" "0364" "0326" "0332"
"0000".
        01  DISP-STATUS        PIC ---------9.
        PROCEDURE DIVISION.
        START-HERE.
              CALL "INITAL" USING  BUFFER,
                                   BUFFER-SIZE,
                                   SYSTEM-STATE,
                                   RET-CODE.
              IF INITAL-SUCCESSFUL
                NEXT SENTENCE
              ELSE
                MOVE "RP CANNOT START" TO MESG-DESC
                MOVE RET-CODE TO RET-STATUS
                PERFORM PROCESS-ERROR
                GO TO PGM-END.
              COPY IDMS SUBSCHEMA-BINDS.
       WAIT-HERE.
              MOVE SPACES TO OUTFILE-NAME.
              MOVE ZEROES TO REC-COUNT.
              MOVE SPACES TO LOGICAL-CHANNEL, NTM-SOURCE,
MESSAGE-TYPE.
              CALL "RCV" USING LOGICAL-CHANNEL,
                               WAIT-FLAG,
                               NTM-SOURCE,
                               MESSAGE-TYPE,
                               DATA-LENGTH,
                               MESSAGE-BODY-IN,
                               ACCEPT-STATUS,
                               MESSAGE-SERIAL-NUMBER.
              IF RCV-NORMAL-MESSAGE
                  NEXT SENTENCE
              ELSE
                  MOVE "UNABLE TO RECEIVE DRS REQUEST" TO MESG-DESC
                  MOVE ACCEPT-STATUS TO RET-STATUS
                  PERFORM PROCESS-ERROR
                  GO TO PGM-ABORT.
YANKME*       DISPLAY "WAITING FOR NEXT INPUT MESSAGE:"
YANKME*       ACCEPT INPUT-CARD.
YANKME*       MOVE SPACES TO MESSAGE-BODY-IN.
YANKME*       MOVE INPUT-CARD TO MESSAGE-BODY-IN.
YANKME*       DISPLAY "==>" MESSAGE-BODY-IN.
                  MOVE ZEROES TO RET-STATUS.
        TRY-OPEN.
              IF CASE-NO NOT = "000000" GO TO TRY-CLOSE.
       *
       *      IDMS   INITIALIZATION
       *
              READY          USAGE-MODE IS UPDATE.
              PERFORM IDMS-STATUS.
              IF NOT OK
                  MOVE KES-IDMS-READY-FAILED TO RET-STATUS
                  STRING "IDMS READY FAILED"       DELIMITED BY
SIZE
                         DISP-STATUS               DELIMITED BY
SIZE
                         INTO MESG-DESC
                  GO TO PGM-ABORT
            ELSE
                GO TO END-CASE-CHECK.
        TRY-CLOSE.
            IF CASE-NO NOT = "CLS" GO TO TRY-COMMIT.
            FINISH.
            PERFORM IDMS-STATUS.
            IF NOT OK
                MOVE KES-IDMS-FINISH-FAILED TO RET-STATUS
                STRING "IDMS FINISH FAILED"       DELIMITED BY
SIZE
                            DISP-STATUS           DELIMITED BY
SIZE
                        INTO MESG-DESC
                GO TO PGM-ABORT
            ELSE
                GO TO END-CASE-CHECK.
        TRY-COMMIT.
            IF CASE-NO NOT = "CMT"
                GO TO TRY-BEGIN.
            COMMIT.
            PERFORM IDMS-STATUS.
            IF NOT OK
                MOVE KES-IDMS-COMMIT-FAILED TO RET-STATUS
                STRING "IDMS COMMIT FAILED"        DELIMITED BY
SIZE
                            DISP-STATUS            DELIMITED BY
SIZE
                        INTO MESG-DESC
                GO TO PGM-ABORT
            ELSE
                GO TO END-CHECK.
        TRY-BEGIN.
            IF CASE-NO NOT = "BEG" GO TO TRY-ROLLBACK
            READY            USAGE-MODE IS UPDATE.
            PERFORM IDMS-STATUS.
            IF NOT OK
                MOVE KES-IDMS-READY-FAILED TO RET-STATUS
                STRING "IDMS READY FAILED" DISP-STATUS
                DELIMITED BY SIZE INTO MESG-DESC
                GO TO PGM-ABORT
            ELSE
                GO TO END-CASE-CHECK.
        TRY-ROLLBACK.
            IF CASE-NO NOT = "RBK"
                GO TO END-FIXED-CASES.
            ROLLBACK.
            PERFORM IDMS-STATUS.
            IF NOT OK
                MOVE KES-IDMS-ROLLBACK-FAILED TO RET-STATUS
                STRING "IDMS ROLLBACK FAILED"       DELIMITED BY
SIZE
                            DISP-STATUS             DELIMITED BY
SIZE
                        INTO MESG-DESC
                GO TO PGM-ABORT
            ELSE
                GO TO END-CASE-CHECK.
        IDMS-STATUS.
            MOVE ERROR-STATUS TO DNMS-STATUS, DISP-STATUS.
        END-FIXED-CASES.
                  MOVE CASE-NO TO RP-SUB-NAME.
               CALL RP-SUB-NAME  USING MESSAGE-BODY-IN
                                       MESSAGE-BODY-OUT
               ON EXCEPTION
               MOVE KES-NO-RSUB-ERROR TO RET-STATUS
               SRING " CANNOT CALL: "
                     RP-SUB-NAME
                     " CASE/SUB: "
                     CASE-NO
                     SUB-ID            DELIMITED BY SIZE
               INTO MESG-DESC
               GO TO PGM-ABORT.
*
*  CALL WORKED--
*
       MOVE QP-STATUS TO RET-STATUS.
          GO TO END-CASE-CHECK.
```

IDMS REQUEST PROCESSOR MACROS

```
LIBRARY:  IDMS
  MACRO:  RPGO


IDENTIFICATION DIVISION.
PROGRAM-ID. P1.
ENVIRONMENT DIVISION.
IDMS-CONTROL SECTION.
PROTOCOL.   MODE IS BATCH DEBUG
            IDMS-RECORDS WITHIN WORKING-STORAGE SECTION.
 DATA DIVISION.
*
SCHEMA SECTION.
DB  P6  WITHIN  P3.

WORKING-STORAGE SECTION.
01  RET-STATUS PIC X(5).
01  MODULE-NAME         PIC X(8) VALUE "P1".
01  MESG-DESC  PIC X(60).
01  MSG-OUT-L  PIC 9(5) COMP VALUE 91.
01  RP-SUB-NAME      PIC X(6).
 COPY ERRCDM OF IISSCLIB.
*                          WS FOR IDMS
01  DBMS-STATUS         PIC X(4).
    88  EOA  VALUE "0307".
    88  EOS  VALUE "0307".
    88  EOC  VALUE "0364" "0326" "0332".
    88  EOO  VALUE "0307".
    88  OK-STATUS  VALUE "0000".
    88  OK  VALUES "0307" "0364" "0326" "0332" "0000".
    88  NON-FATAL  VALUES "0307" "0364" "0326" "0332" "0000".
01  DISP-STATUS         PIC ---------9.

 LINKAGE SECTION.
*    MESSAGE FROM DRS
01  MESSAGE-BODY-IN.
    03  CASE-NO         PIC X(6).
    03  SUB-ID PIC XXX.
     03  MESSAGE-PARAMETERS    PIC X(2000).
*    REPLY TO DRS
01  MESSAGE-BODY-OUT.
    03  OUTFILE-NAME    PIC X(80).
    03  REC-COUNT       PIC 9(6).
    03  QP-STATUS               PIC X(5).
01  LOGICAL-CHANNEL     PIC X(3).
01  DATA-LENGTH         PIC 9(5) COMP.
PROCEDURE DIVISION USING
            LOGICAL-CHANNEL
            DATA-LENGTH
            MESSAGE-BODY-IN
            MESSAGE-BODY-OUT.
START-HERE.
     MOVE SPACES TO OUTFILE-NAME.
     MOVE ZEROES TO REC-COUNT.
     MOVE ZEROES TO RET-STATUS.
     COPY IDMS SUBSCHEMA-BINDS.
TRY-OPEN.
      IF CASE-NO NOT = "000000" GO TO TRY-CLOSE.
*
*     IDMS  INITIALIZATION
*
     READY          USAGE-MODE IS UPDATE.
     PERFORM IDMS-STATUS.
     IF NOT OK
        MOVE KES-IDMS-READY-FAILED TO RET-STATUS
        STRING "IDMS READY FAILED"          DELIMITED BY SIZE
               DISP-STATUS                  DELIMITED BY SIZE
               INTO MESG-DESC
        GO TO PGM-ABORT
    ELSE
        GO TO END-CASE-CHECK.
TRY-CLOSE.
     IF CASE-NO NOT = "CLS" GO TO TRY-COMMIT.
     FINISH.
     PERFORM IDMS-STATUS.
     IF NOT OK
         MOVE KES-IDMS-FINISH-FAILED TO RET-STATUS
         STRING "IDMS FINISH FAILED"         DELIMITED BY SIZE
                DISP-STATUS                  DELIMITED BY SIZE
             INTO MESG-DESC.
TRY-COMMIT.
     IF CASE-NO NOT = "CMT"
          GO TO TRY-BEGIN.
     COMMIT.
     PERFORM IDMS-STATUS.
     IF NOT OK
          MOVE KES-IDMS-COMMIT-FAILED TO RET-STATUS
          STRING "IDMS COMMIT FAILED"        DELIMITED BY SIZE
                 DISP-STATUS                 DELIMITED BY SIZE
              INTO MESG-DESC
          GO TO PGM-ABORT
     ELSE
          GO TO END-CASE-CHECK.
TRY-BEGIN.
     IF CASE-NO NOT = "BEG"  GO TO TRY-ROLLBACK.
     READY           USAGE-MODE IS UPDATE.
     PERFORM IDMS-STATUS.
     IF NOT OK
         MOVE KES-IDMS-READY-FAILED TO RET-STATUS
         STRING "IDMS READY FAILED" DISP-STATUS
         DELIMITED BY SIZE INTO MESG-DESC
         GO TO PGM-ABORT
     ELSE
         GO TO END-CASE-CHECK.
TRY-ROLLBACK.
     IF CASE-NO NOT = "RBK"
         GO TO END-FIXED-CASES.
     ROLLBACK.
     PERFORM IDMS-STATUS.
     IF NOT OK
         MOVE KES-IDMS-ROLLBACK-FAILED TO RET-STATUS
         STRING "IDMS ROLLBACK FAILED"          DELIMITED BY SIZE
                DISP-STATUS                     DELIMITED BY SIZE
                INTO MESG-DESC
        GO TO PGM-ABORT
    ELSE
        GO TO END-CASE-CHECK.
    IDMS-STATUS.
        MOVE ERROR-STATUS TO DBMS-STATUS, DISP-STATUS.
    END-FIXED-CASES.
             MOVE CASE-NO TO RP-SUB-NAME.
          CALL RP-SUB-NAME USING MESSAGE-BODY-IN
                                      MESSAGE-BODY-OUT
           ON EXCEPTION
              MOVE KES-NO-RPSUB-ERROR TO RET-STATUS
              STRING " CANNOT CALL: "
                     RP-SUB-NAME
                     " CASE/SUB: "
                     CASE-NO
                     SUB-ID       DELIMITED BY SIZE
              INTO MESG-DESC
              GO TO PGM-ABORT.
*
*  CALL WORKED--
*
      MOVE QP-STATUS TO RET-STATUS.
      GO TO END-CASE-CHECK.
```

LIBRARY: IDMS
MACRO: RPEND

```
          PGM-ABORT.
              MOVE ZERO TO REC-COUNT.
          END-CASE-CHECK.
              MOVE RET-STATUS TO QP-STATUS
            IF RET-STATUS NOT = ZEROES
               PERFORM PROCESS-ERROR.
              MOVE NTM-SOURCE TO NTM-DESTINATION.
              MOVE SPACES TO TIMEOUT-VALUE.
            MOVE "N" TO DATA-TYPE.
YANKME*           DISPLAY 'REPORTING STATUS'.
YANKME*        DISPLAY MESSAGE-BODY-OUT.
YANKME*        DISPLAY '----------------'.
            CALL "NSEND" USING  NTM-DESTINATION,
                                LOGICAL-CHANNEL,
                                TIMEOUT-VALUE,
                                DATA-TYPE,
                                OUT-MESSAGE-TYPE,
                                MSG-OUT-L
                                MESSAGE-BODY-OUT
                                ACCEPT-STATUS.
            IF SEND-MSG-ACCEPTED
                  IF CASE-NO  =  "CLS"
                     GO TO PGM-END
                  ELSE
                     GO TO WAIT-HERE

            ELSE
                MOVE "RP CANNOT REPLY TO DRS" TO MESG-DESC
                PERFORM PROCESS-ERROR
                GO TO PGM-END.
        PGM-END.
       *
       *  TRMNAT DOES A COBOL STOP RUN
       *
              CALL "TRMNAT"     USING    TERMINATION-STATUS.
YANKME*   STOP RUN.
       *
       *  INCLUDE THE ERRPRO OF IISSCLIB.
       *
          COPY ERRPRO OF IISSCLIB.
YANKME*PROCESS-ERROR.
YANKME*    DISPLAY 'ERRPRO**********'.
YANKME*    DISPLAY RET-STATUS.
YANKME*    DISPLAY MODULE-NAME.
YANKME*    DISPLAY MESG-DESC.
YANKME*    DISPLAY '*****************'.
/*
```

IDMS REQUEST PROCESSOR MACROS

LIBRARY: IDMS
MACRO: RPSTOP

```
PGM-ABORT.
     MOVE ZERO TO REC-COUNT.
END-CASE-CHECK.
     MOVE RET-STATUS TO QP-STATUS.
     IF RET-STATUS NOT = ZEROES
          PERFORM PROCESS-ERROR.
     MOVE MSG-OUT-L TO DATA-LENGTH.
PGM-END.
     EXIT PROGRAM.
     COPY ERRPRO OF IISSCLIB.
```

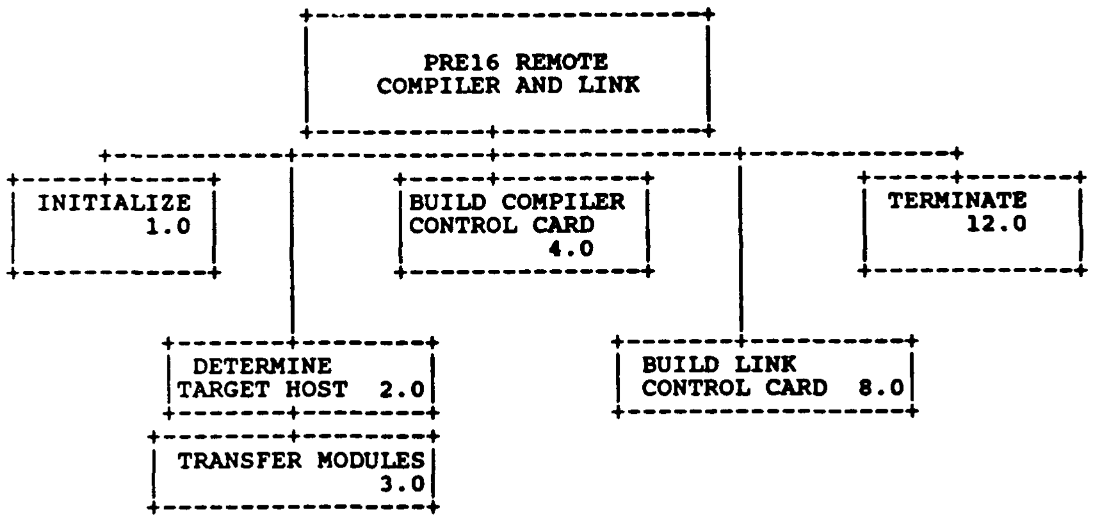
SECTION 42

Function PRE16 - Precompiler Remote Compile and Link

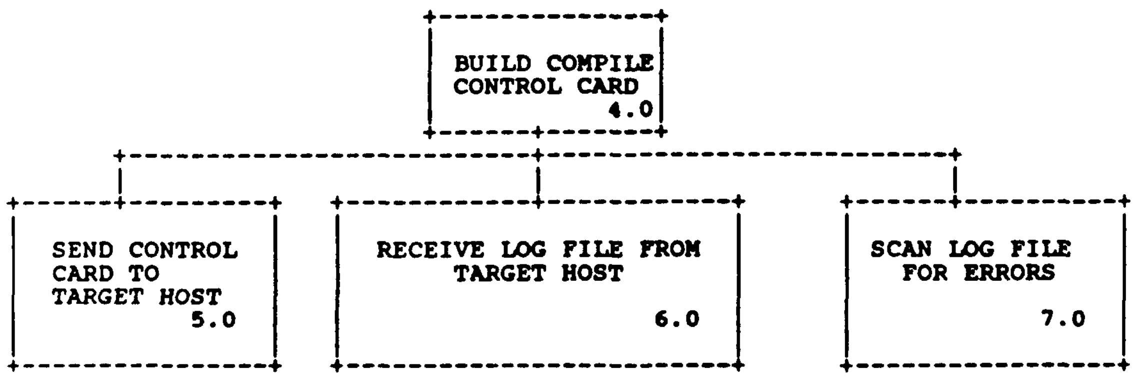
This function requests the Network Transaction Manager (NTM) to compile and link all modules generated from precompilation. PRE16 will transfer all files to the appropriate host computer, build the control cards needed to compile and link the modules and access the NTM service "SNDRCLE" to execute these control cards.

The following structure charts illustrate the major functions to be accomplished by PRE16.

REMOTE COMPILE AND LINK


PRE16 REMOTE COMPILER AND LINK
INITIALIZE 1.0
BUILD COMPILER CONTROL CARD 4.0
TERMINATE 12.0
DETERMINE TARGET HOST 2.0
BUILD LINK CONTROL CARD 8.0
TRANSFER MODULES 3.0

REMOTE COMPILER AND LINK


BUILD COMPILE CONTROL CARD 4.0
SEND CONTROL CARD TO TARGET HOST 5.0
RECEIVE LOG FILE FROM TARGET HOST 6.0
SCAN LOG FILE FOR ERRORS 7.0

REMOTE COMPILE AND LINK (CONT'D)

```
                    +-------------------+
                    |    BUILD LINK     |
                    |   CONTROL CARD    |
                    |              8.0  |
                    |                   |
                    +---------+---------+
     +--------------------------+---------------------------+
     |                          |                           |
+----+-------+    +------------+-------------+    +------+----------+
|SEND CONTROL|    |   RECEIVE LOG FILE FROM  |    |SCAN LOG FILE    |
|CARD TO     |    |       TARGET HOST        |    |  FOR ERRORS     |
|TARGET HOST |    |                      10.0|    |           11.0  |
|         9.0|    |                          |    |                 |
+------------+    +--------------------------+    +-----------------+
```

42.1 Inputs:

1. Code Generator Table

The Code Generator Table contains the results about all code generated or modified by the precompiler. This table is passed to CDRCL from module NDML. The fields used by CDRCL are CGT-CURRENT-HOST, CGT-DBMS, CGT-GEN-FILE-NAME, CGT-INDEX, CGT-LOG-FILE-NAME, CGT-MOD-NAME, CGT-TARGET-HOST, and CGT-USED.

* CGTABLE.INC

```
 01   CODE-GENERATOR-TABLE
 03   CGT-USED                    PIC 999 VALUE 0.
 03   CGT-MAX                     PIC 999 VALUE 189.
 03   CGT-ENTRY   OCCURS 190 TIMES    INDEXED BY CGT-INDEX
      05  CGT-MOD-NAME            PIC X(10).
      05  CGT-LANGUAGE            PIC X(8).
      05  CGT-TARGET-HOST         PIC XXX.
      05  CGT-DBMS                PIC X(30).
      05  CGT-DB-NAME             PIC X(30).
      05  CGT-MOD-TYPE            PIC X(10).
          88  USER-MODULE         VALUE "USER-MOD".
          88  RP-MAIN             VALUE "RP-MAIN".
          88  RP-SUB              VALUE "RP-SUB".
          88  CS-ES               VALUE "CS-ES".
      05  CGT-ACTION              PIC X.
      05  CGT-GENED-BY            PIC X(10).
      05  CGT-GEN-FILE-NAME       PIC X(30).
      05  CGT-PASSWORD            PIC X(30).
      05  CGT-LOCALITY            PIC X.
          88  CGT-LOCAL           VALUE "L".
          88  CGT-REMOTE          VALUE "R".
*
*     THE ABOVE CAN BE SHOWN TO THE USER, THE FOLLOWING ARE FOR
*     RCL AND INTERNAL USAGE:
      05  CGT-DBID                PIC 9(6).
      05  CGT-LIBRARY-NAME        PIC X(30).
      05  CGT-SUBTRANS-ID         PIC 9(6).
      05  CGT-CASE-NO             PIC 9(6).
      05  CGT-SCHEMA              PIC X(30).
      05  CGT-SUBSCHEMA           PIC X(30).
      05  CGT-DB-LOCATION         PIC X(30).
      05  CGT-PASSWORD            PIC X(30).
*     THE FOLLOWING ARE REQUIRED FOR RCL FUNCTIONS
      05  CGT-LOG-FILE-NAME       PIC X(30).
      05  CGT-RCL-LOG-CHAIN       PIC XXX.
      05  CGT-CURRENT-HOST        PIC XXX.
*     NOTE THAT CURRENT HOST MAY CHANGE DURING THE RCL PROCESS
      05  CGT-RCL-STATUS          PIC X(5).
          88  CODE-GEN            VALUE "GEN".
          88  CODE-XFERRED        VALUE "XFER".
          88  CODE-COMPILED       VALUE "COMP".
          88  AP-LINKED           VALUE "LINK".
          88  AP-DEFINED          VALUE "NTM".
```

42.2 Internal Requirements:

1. The Control Card Area Table contains the control cards needed to compile and link program modules on various host computers for various DBMs. It also contains the error keywords used to search the log files to determine if errors occurred during the compilation and linking of modules.

```
*
01  CONTROL-CARD-AREA-TABLE.
03  CGT-USED                      PIC 999 VALUE 0.
03  CGT-MAX                       PIC 999 VALUE 20.
    05  FILLER.
        07  FILLER                PIC X(3) VALUE "VAX".
        07  FILLER                PIC X(30) VALUE "COBOL".
            09  FILLER            PIC X(70) VALUE.
           "@RPLIB P1".
            09  FILLER            PIC XX.
        07  FILLER                PIC X(10) VALUE "%COBOL".
    05  FILLER
        07  FILLER                PIC X(3) VALUE "VAX".
        07  FILLER                PIC X(30) VALUE.
                                  "VAX-11"
        07  FILLER.
            09  FILLER            PIC X(70) VALUE.
           "LKVAX11 P1 NODEBUG".
            09  FILLER            PIC XX.
        07  FILLER                PIC X(10) VALUE "%LINK".

03  CONTROL-CARD-TABLE REDEFINES CONTROL-CARD-AREA.
    05  CONTROL-CARD-REC OCCURS 20 TIMES
        INDEXED BY CGT-INDEX.
        07  CGT-HOST              PIC XXX.
        07  CGT-FUNC-DBMS         PIC X(30).
        07  CGT-CTL-CARD
            09  CGT-CONTROL-CARD  PIC X(70).
            09  CGT-TERMINATOR    PIC XX.
        07  CGT-ERROR-KEYWORD     PIC X(10).
*
*   TERMINATOR CONTAINS A 'IE' IN HEXADECIMAL ENTERED
*   WITH A CONTROL/6 ON A DEC VT100 SERIES TERMINAL
*   CONSTANT, TO BE MOVED TO CGT-TERMINATOR IN PROCESS
*
03  TERMINATOR
    05  FILLER                    PIC X VALUE ' '.
    05  FILLER                    PIC X VALUE ' '.
```

42.3 Constraints:

1. None

42.4 Outputs:

1. A status code indicating whether function CDRCL was successful.

```
01  RET-STATUS        PIC X(5)
```

42.5 PROCESSING:

Remote Compile and Link PRE16, module CDRCL transfers all generated routines from the precompiler that need to be transferred to a host computer. When all routines are transferred, CDRCL calls BLDCC to build the control cards to compile the routines and then sends the control cards to the target host computer. A log file is returned for each compiled routine and is scanned by LOGANA for error conditions. If no errors exist in any of the compiles, CDRCL calls BLDCC to generate the control cards to link the main routines. CDRCL sends these cards to the target host, a log file is returned for each, and then LOGANA is called to scan the log files for error conditions.

Modules that are called by CDRCL other than BLDCC and LOGANA are:
FILXFR to transfer files; SNDRCLE to send control cards; RCV to receive the log file name; DELFIL to delete the log file; ERRPRO to process error codes. SNDRCLE and RCV are part of the NTM services. FILXFR and DELFIL are part of the CDM File Utilities Configuration Item. ERRPRO is part of the COMM subsystem.

1. Initialize CDRCL.

   1.1 Set internal flags and RET-STATUS to default values.

2. Check for generated source code that needs to be transferred to different host.

   2.1 Compare each CGT-TARGET-HOST to CGT-CURRENT-HOST, if the values are different, set up parameters to transfer the routine to the target host.

3. Transfer each routine identified in Step 2.1

   3.1 Call FILXFR passing the parameters needed to transfer the routine from the current host to the target host.

4. Build compile control card for each entry in the Code Generator Table.

   4.1 Call "BLDCC" to build the compile control card from the CONTROL-CARD-TABLE using CGT-LANGUAGE in the selection.

5. Send control card to target host for each entry found in Step 4.

   5.1 Call "SNDRCLE" to send the compile control card to the target host as specified by CGT-TARGET-HOST.

6. Obtain log file from target host for each entry found in Step 4.

   6.1 Call "RCV" to obtain the log file name.

   6.2 If the log file is on a host other than the current host, call "FILXFR" to transfer the log file to the current host as specified by CGT-CURRENT-HOST.

7. Scan each log file for errors.

   7.1 Call LOGANA to scan the log file for an error keyword as specified by CCT-ERR-KEYWORD for the compile indicated by CGT-LANGUAGE.

8. Build link control card for each entry in the Code Generator Table that is a main program, and is not a Local request processor (CGT-LOCAL).

   8.1 Call "BLDCC" to build the link control card from CONTROL-CARD-TABLE using CGT-DBMS in the selection.

9. Send control card to target host for each entry found in Step 8.

   9.1 Sets up parameters and calls SNDRCLE to send the link control card to the target host.

10. Obtain log file from target host for each entry found in Step 8.

    10.1 Call "RCV" to obtain the log file name.

    10.2 If the log file is on a host other than the current host, call "FILXFR" to transfer the log file to the current host as specified by CGT-CURRENT-HOST.

11. Scan each log file for errors.

    11.1 Call LOGANA to scan the log file for an error keyword as specified by CCT-ERROR-KEYWORD for the link indicated by CGT-DBMS.

12. Terminate.

    12.1 Terminates CDRCL.

SECTION 43

QUALITY ASSURANCE PROVISION

In preparation for describing requirements for quality assurance provisions it is appropriate to define the terms "test" and "debug" which are often used interchangeably. "Testing" is a systematic process that may be preplanned and explicitly scheduled. Test techniques and procedures may be defined in advance and a sequence of test steps may be specified. "Debugging" is the process of isolation and correction of the cause of an error. To start with, the concept of "antibugging" is recommended in the construction of the software modules. In his text on software development (Techniques of Program Structure and Design, Prentice-Hall, 1975), Yourdon defines antibugging as "the philosophy of writing programs in such a way as to make bugs less likely to occur, and when they do occur (which is inevitable), to make them more noticeable to the programmer and the user." That is, do as much error checking as is practical and possible in each routine.

Among the tests that should be incorporated into all software are:

1. input data checks
2. interface data checks, i.e., tests to determine validity of data passed from calling routine
3. database verification
4. operator command checks
5. output data checks

Not all tests are required in all routines, but error checking is an essential part of all software.

The CI quality assurance provisions must consist of three levels of test, validation and qualification of the constructed application software.

A. The initial level can consist of the normal testing techniques that are accomplished during the construction process. They consist of design and code walk-throughs, unit testing, and integration testing. These tests will be performed by the design team which will be organized in a manner similar to that discussed by Weinberg in his text on software development team organization (The Psychology of Computer Programming, New York: Van Nostrand Reinhold, 1971). Essentially a team is assigned to work on a subsystem or CI. This approach has been referred to as "adaptive teams" and "egoless teams". Members of the team are involved in the overall design of the subsystem. There is better control and members are exposed to each other's design. The specific advantages from a quality assurance point is the formalized critique of design walk-throughs which are a preventive measure for desing errors and program "bugs". Structured design, design walk-throughs and the incorporation of "antibugging" facilitate this level of testing by exposing and addressing problem areas before they become coded "bugs."

B. Preliminary qualification tests of the CI are performed to highlight the special functions of the CI from an integrated point of view. Certain functional requirements may require the cooperative execution of one or more modules to achieve an intermediate or special function of the CI. Specific test plans will be provided for the validation of this type of functional requirement including preparation of appropriate test data. (Selected functions from 3.2 must be listed).

C. Formal Qualification Test will verify the functional performance of all the modules, within the CI as an integrated unit, that accept the specified input, perform the specified processes and deliver the specified outputs. Special consideration must be given to test data to ensure verification that proper interface of modules has been constructed.

SECTION 44

PREPARATION FOR DELIVERY

The implementation site for the constructed software will be the ICAM Integrated Support System (IISS) Test Bed site located at Arizona State University, Tempe AZ. The required computer equipment will have been installed. The constructed software will be transferred to the IISS system via appropriate storage media.

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